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SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL

No. 83 AUTUMN 1952

ONE SHILLING

In this Issue

The Effect of Air Pollution on Forest Trees
Damage to Structures
" Lady " Hopwood of Middleton
The Mobile Testing Units of the M. of F. and P.
The Sanitary Inspector and Smoke Abatement
etc., etc.

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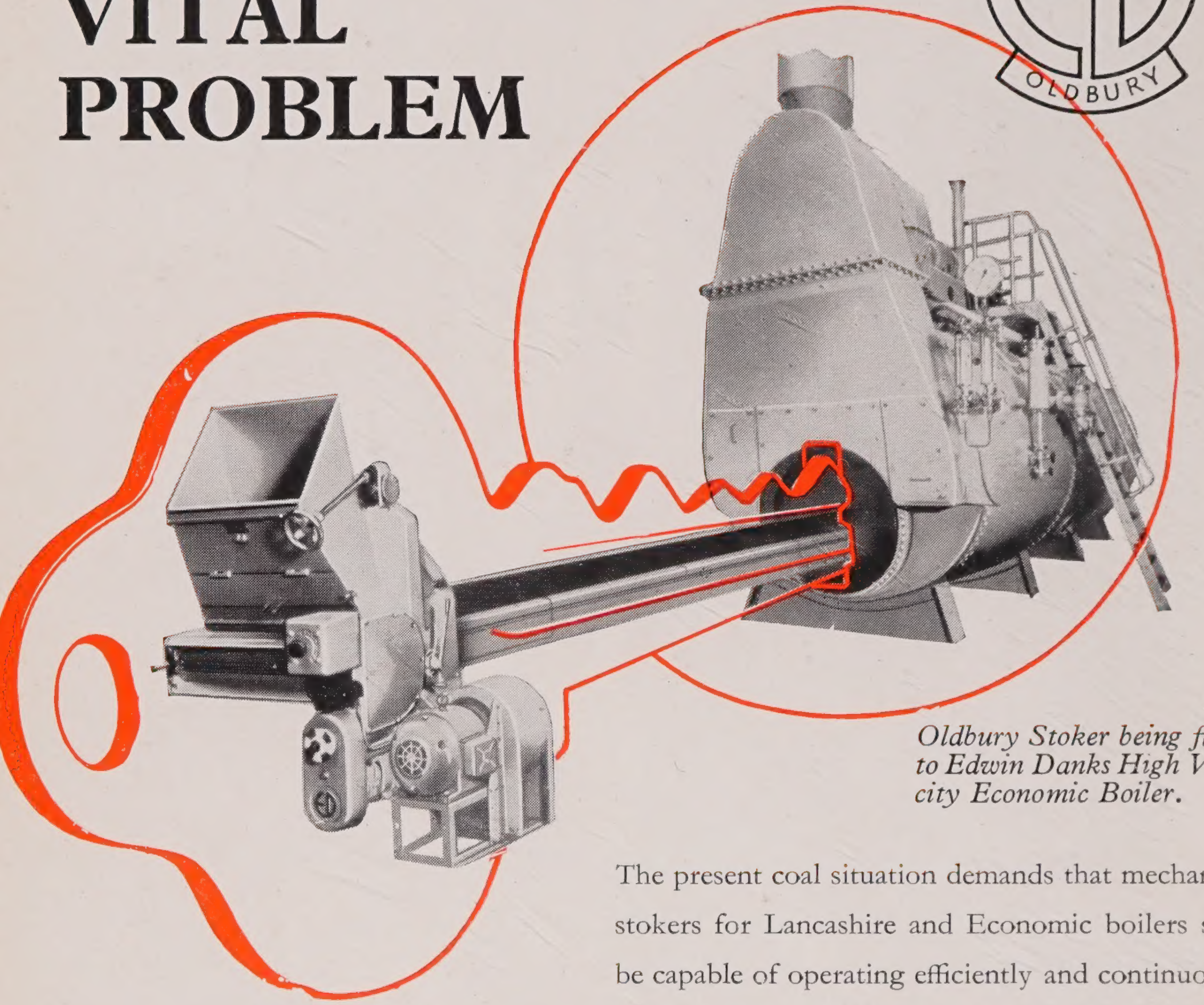

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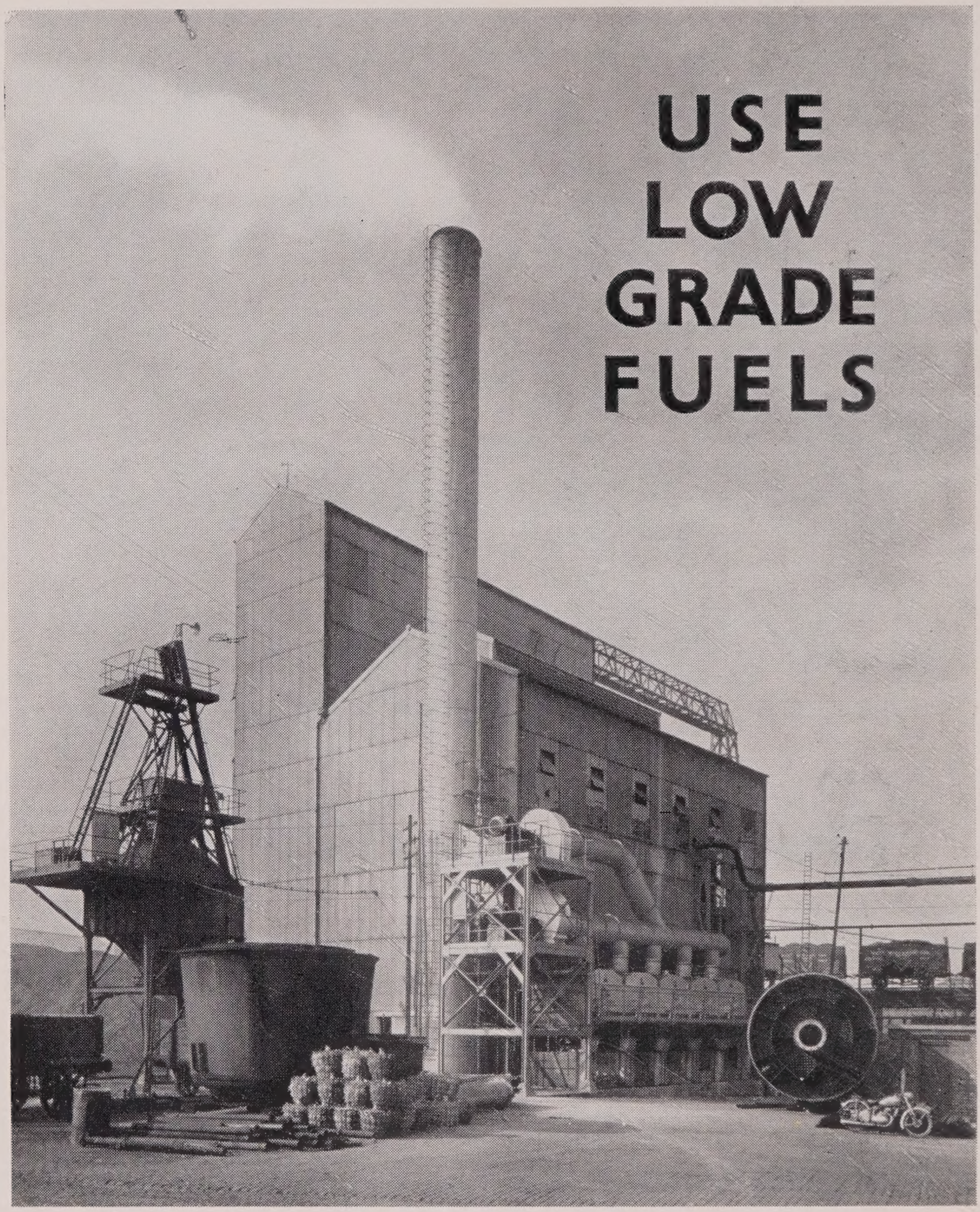

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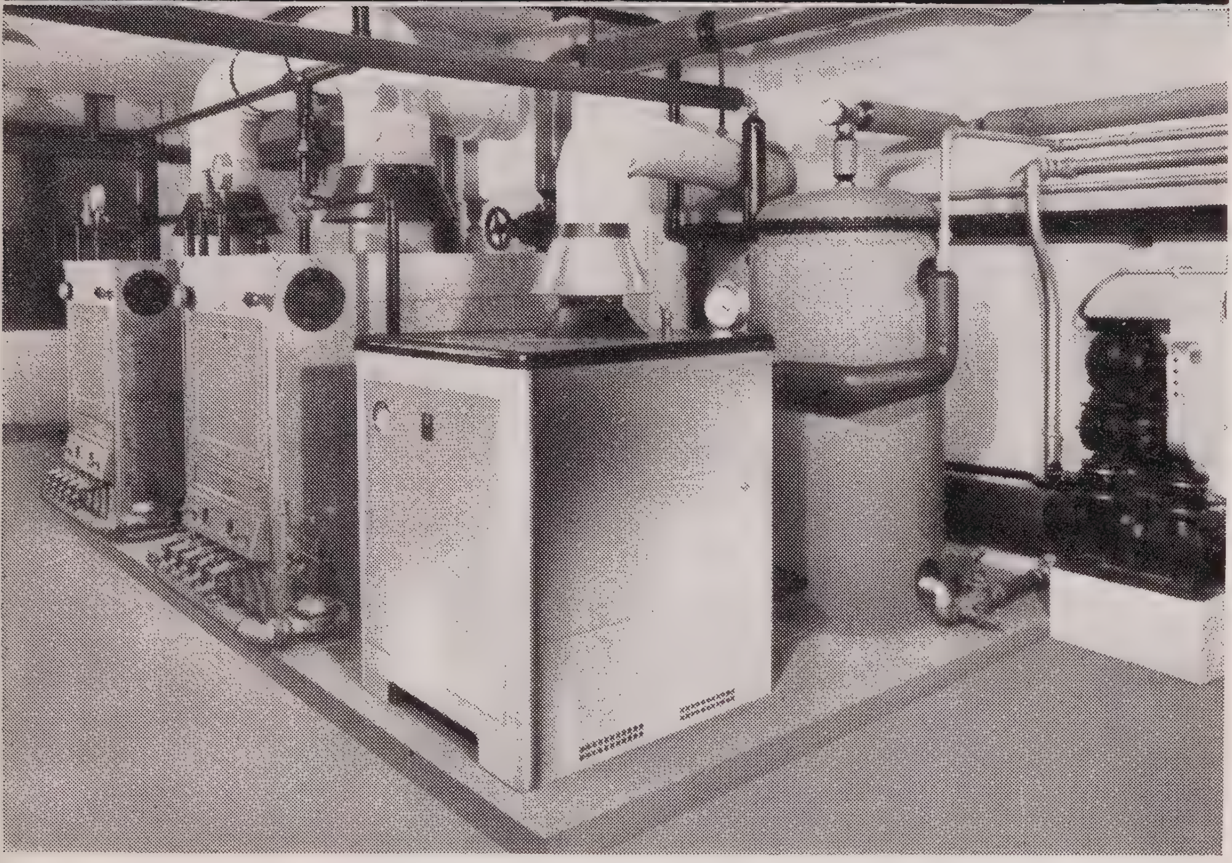

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SMOKELESS AIR

Vol. XXIII. No. 83 Autumn, 1952

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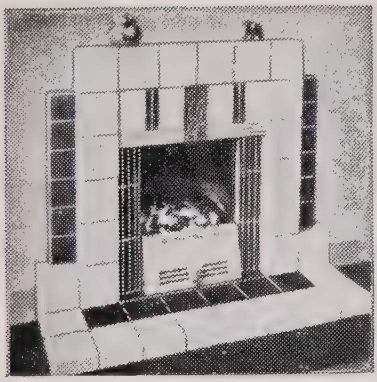

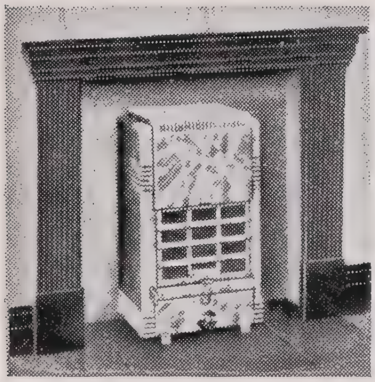

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SMOKELESS AIR

Conference

At the time of writing the number of registrations for the Portsmouth conference is approaching that of all recent years, and we can expect nearly 400 members and delegates to assemble in the theatre of the South Parade Pier at Southsea on September 24th to be welcomed by the Lord Mayor. The papers to be read were described in our last issue, but an important late addition will be a " Progress Report " on smoke in relation to cancer of the lung, to be given by Dr. Percy Stocks, formerly Chief Medical Statistician of the General Register Office, and now Senior Research Fellow, British Empire Cancer Campaign and Medical Statistician to the World Health Organization. His paper is of such importance that it is intended to publish it in our winter issue, so that it may be read by the many who do not obtain the conference *Proceedings*.

Annual Meeting

The one possibly controversial item on the agenda for the annual general meeting, which it may have been noted is to be held at the end of the conference instead of near the beginning as before, is a proposal to increase the minimum rates of membership subscription. The appeal for voluntary increases, which was sent to all members, has had a generally gratifying response, and as the financial statement for the year ended June 30th will show, has greatly strengthened the Society's position. Some members, however, have said that they would prefer the constitution to be altered to regularize the subscription position, and the A.G.M. will show whether this desire is general. Many members, of course, already subscribe well above the minimum rates, and their position will not be affected by the small changes proposed.

It is hoped that members, on seeing the income and expenditure account with its surplus of several hundred pounds, will not include that the Society's financial difficulties are over. This year's credit balance is not enough to cover the withdrawals from reserves that had to be made in recent years, and does not as yet make possible even the small essential developments that are necessary if the Society is to carry on with efficiency and security.

Advice to Doctors

Accused by implication as we are in a letter on another page, of a lack of virility, it is consoling to see that commentators of experience continue to express more encouraging opinions about the worth of the Society. Thus in one of the articles in an important symposium on " Climate, Environment and Health " that appeared in the June, 1952, number of *The Practitioner* (an abstract of which is given elsewhere) the authors discuss the effects of atmospheric pollution on health and then say:

" What can be done to remedy, or at least to mitigate these effects? First, the initiative in the fight against smoke lies in the capable hands of the National Smoke Abatement Society . . . The excellent work which this Society has already done in investigating new types of fuel, in the education of industrial firms and the general public in the better use of fuel, and in pressing for legislation to solve the smoke problems, has already had beneficial results. Yet much more can be done, and to further their efforts they need the active co-operation of the medical profession. Doctors can and should give their support whenever an opportunity arises."

Too Modest

Then, again from a medical source, the weekly journal *The Medical Press*, reviews at some length the Society's Year Book for 1952. It quotes our statement on the development of smokeless zones: " It is beginning of an experiment, or rather an evolution of which the Society may claim considerable credit," and comments " Had the passage read ' the principal credit ' we should not have regarded it as passing the limits of ordinary modesty. It is a matter of simple fact that if the Society had not been in existence even the Coventry smokeless zone would not have been introduced and the beginning of the experiment would still be some decades in the future. It is, presumably, true that the number of individual objectors to atmospheric pollution by smoke would have been steadily increasing, but the legislative preparation of the ground could never have been accomplished by individuals against the dead weight of inertia and conservatism and—let us be frank—vested interests. *Only an organized body of accepted standing could have produced the favourable social climate which was necessary.*"

We have taken the liberty of italicizing the last sentence because it so well sums up the real answer to the question we are often asked: " Well, what exactly *has* the Society achieved ?" It has done—and is doing—something that has results that are difficult to define, describe or measure, but which are nevertheless real and important.

Notifiable Disease

We also like the discussion in the same article on how smoke prevention infringes the so-called right to burn what we like, how we like, regardless of the consequences to others. "A century ago," says *The Medical Press*, " it was being realized that while the individual was at liberty to have cholera if he so desired, he was not at liberty to distribute infection freely to those who might not desire it. The principle that a Local Authority may establish smokeless zones is every bit as important as the principle that sufferers from notifiable diseases shall not travel in public service vehicles."

Ladies Close Coal Mine

We hope our American friends do not take amiss the fact that some of our occasional odder news stories come from their side of the Atlantic. The reason they are of interest is just because they don't happen here. Take for instance the story of the forty irate ladies of Granville, West Virginia, a small township with a population of one thousand. They grew tired of cleaning up the dust that came from the coal cleaning plant of the local mines, and one day in June they got together and marched down to the cleaning plant, where they set up picket lines.

" The men came to work," continues the press account, " eyed the determined ladies with embarrassment, then meekly returned home. With the big coal-cleaning plant and tipple closed, the company had no alternative but to shut down its Arkwright and Osage mines." The sequel was that Mayor Clinton Cairney had to call a special meeting in the Town Hall to calm the ladies down and persuade them to permit the biggest industry in the area to go back into operation.

No, it wouldn't happen here—though we rather wish it would!

And Now APCA

A little while ago, discussing the possibility of changing our own name, it was suggested that anything new should be short and manageable. We ventured to say that our kindred society in the States might be finding its own new title, the Air Pollution and Smoke Prevention Association of America, rather unwieldy. Without imagining that this remark had any influence in the matter, we are interested to see that the Association has decided to shorten its name, and will be known as the Air Pollution Control Association. Very much easier and more economical—although we doubt if our own members would approve the word " Control."

The Veto on Salford

As Dr. Burn himself is to give a Progress Report at Portsmouth on Smokeless Zones, and as a resolution may be moved on the Salford case, we do not wish to say too much at the moment on the decision, of the Minister of Housing and Local Government, briefly reported in our last issue, not to confirm the Salford residential areas smokeless zone scheme. The matter is, however, of considerable importance, especially as the reasons given for the refusal are very much open to question. It was said that the necessary supply of smokeless fuel cannot be ensured and that the conversion of installations would be difficult because of steel shortage. The number of houses involved is however relatively so small that the coke and semi-coke producers are both quite confident of being able to maintain supplies—Salford is in a coke exporting area—and the number of new appliances required could not be more than a minute fraction of the million or more that are being installed up and down the country this year. It is difficult to avoid the conclusion that the Minister is really anxious to avoid creating a precedent, despite the sensible recommendation of the Simon Committee that experimental zones of different kinds should be established. Such a reason could be understood if a spate of similar residential zones was likely to follow, but no others of a similar kind are at present in sight, and in any case the Minister could always point out that they must wait until the lessons of Salford have been learned.

(*See also page* 33)

The Effect of Atmospheric Pollution on Forest Trees in Great Britain

by

T. R. Peace
Forest Pathologist, Forestry Commission

IT has long been known that trees, in common with other types of vegetation, were liable to damage from smoke and industrial fumes. Indeed such knowledge might have preceded the industrial era, since indications of damage to trees by sulphurous gases can be seen in the neighbourhood of geysers and hot springs, as for instance at Yellowstone Park in the United States. Nevertheless, despite the fact that this problem has been present on an ever-increasing scale, since large scale industry started to develop, the amount of accurate information available is curiously limited. There would appear to be two main reasons for this. First, the kind of fumes or smoke causing the damage varies from place to place, so that results in one area are not necessarily applicable to another. Second, in many areas smoke and fumes are not the only causes of injury to the trees concerned, and the damage due to them may be confused with or even completely masked by, that due to other agencies.

The first of these difficulties, the variation in the nature of the toxic agency makes summarization of data collected in different places very difficult, and accounts for the rather startling discrepancies that occur between lists of trees arranged in order of susceptibility by different authors. In a few cases really exhaustive investigations have been made of fume damage to trees, usually in connection with claims for compensation. In nearly every case these were associated with large, isolated factories lying outside the areas where damage is long established and general, and were concerned in most cases with only one kind of poison. The information gained from these cases therefore has only limited value, since it can only be directly applied to other places where the general conditions of climate etc., are similar, and where the toxic gases emitted are the same. Of course, in practice, far the biggest areas of damage lie in highly industrialized districts, where the injury cannot fairly be attributed to any one source of smoke or fumes.

The second difficulty is perhaps even greater. Many of our principal industrial areas are situated in places where the available forest land is poor and often exposed. In some cases alterations in the water level in the soil have taken place as a result of the industrial development; for instance the water table may be lowered by pumping in mines. The damage to health and rate of growth of trees brought about by factors such as these can only be separated from those due to smoke and fumes by careful research. Actually such a separation is seldom made, and as a result the effect of the industrial gases may be greatly underrated or quite as often greatly exaggerated.

Symptoms

Damage to trees is, of course, primarily to the foliage; but, particularly with conifers, repeated injury to the leaves will eventually lead to dieback of twigs and even to the death of the whole tree. Slight injury may have no permanent effect, beyond a reduction in the growth rate. Even this is a very important matter, since the time taken by the trees to reach marketable size depends on the rate at which they grow. On broadleaved trees injury takes the form of a discolouration—first yellow and then brown—of those parts of the leaf furthest from the veins, i.e., furthest from the fresh uncontaminated sap coming up from the roots. The leaf will thus have a mottled appearance, and often a yellow or brown margin. If the injury develops beyond this stage, and it usually does, the leaves will shrivel and fall. The amount of permanent damage done to the health and rate of growth of the tree will depend mainly on how early in the season the damaged leaves fell, and whether the injury affected all the leaves. Naturally most broadleaved trees gain some advantage from their deciduous habit, for they are able to produce fresh uninjured leaves the following spring. But there are obviously other factors coming in, for some of the evergreens, such as holly or Portugal laurel are moderately resistant to injury. Differences are even shown by trees very closely related; for instance the single-leaved variety of the common ash, in which the normal divided leaf is reduced to a single, larger blade of coarser texture, and presumably with a thicker cuticle, is said to be more resistant to town conditions than the ordinary type. The reasons for differences in susceptibility are complex, depending on leaf structure, on the chemical make-up of the tree, on how well able it is to recover from defoliation.

The symptoms on conifers tend to be simpler. The tips of the needles are discoloured first, presumably because they are furthest from the sap stream, which towards the base of the leaf will tend to dilute the toxic agent. Defoliation takes place in the same way as with broadleaved trees, but the actual injury is apt to be more severe, not only because most conifers are evergreen and should hold their needles for three to five years, but because many of them show very poor powers of recovery from the dieback occasioned by the loss of foliage. Again variation in degree of injury between different varieties is not merely a matter of some being evergreen and others not, for the larches, which are the only deciduous conifers of commercial importance, are fairly susceptible to smoke and fume injury.

Conifers and Hardwoods

It has already been pointed out that owing to variations in the kind of fumes concerned, and in the local climatic conditions, which certainly effect the amount of injury on different trees, published lists giving orders of susceptibility are apt to be very contradictory. It is certainly true to say that the majority of conifers are much more susceptible than the majority of hardwoods. Within those groups differences are much less regular, but among the hardwoods sycamore, elm and poplar show considerable resistance, while ash and beech are rather susceptible. In fact a map showing the distribution of sycamore woods in this country calls attention to the industrial areas, for owing to its ability to grow and seed itself, where other trees have perished, sycamore is found particularly in these places. Among the conifers the differences are less pronounced, but Corsican pine and Japanese larch show some resistance, while European larch, Douglas fir, the spruces, and in particular the Silver firs (Abies), and Scots pine are

In the clean air of the Bedgebury Pinetum

susceptible.

There is really no evidence available to show how much damage is done to forest trees by atmospheric pollution, nor to what extent forest planting could be extended, if the atmosphere was more uniformly pure. If it could be assumed that all land available for planting had a rich enough soil to support the growth of the more exacting broadleaved trees, the area lost to forestry would be very small and restricted to the immediate neighbourhood of certain factories. Admittedly though hardwoods such as sycamore or poplar can be planted on any polluted site with good enough soil, there would still be some loss of growth due partly to the defoliation caused by the fumes and partially by the loss of sunlight caused by the smoke in the air. In practice of course the majority of our forest land is not suitable for hardwoods—conifers are able to grow on much poorer soils—and it is the limiting effect of industrial conditions on conifers that we ought to consider. It is very noticeable that healthy conifers are very rare indeed in the heart of any major industrial area. Even at the Royal Botanic Gardens, Kew, the growing of young conifers has proved increasingly difficult, though older specimens remain alive and fairly healthy. To overcome this difficulty a subsidiary Pinetum has been started in the pure air of Bedgebury Forest some twelve miles from Tunbridge Wells in Kent.

A South Wales Investigation

On the other hand, Day and Sanzen Baker in an exhaustive survey of the reasons for poor growth of conifers in two forests in the South Wales mining area (Llanover and Llantrisant) considered that the effect of industrial fumes was largely confined to the immediate neighbourhood of strong sources of fumes such as tin plate works. They did not consider that any appreciable damage could be blamed on the general air pollution over the district as a whole, though judging by soot deposition such pollution did certainly occur. They attributed the bad growth mainly to poor soil conditions and faults in forest practice. Admittedly, South Wales is an area of hard coal, burning with little soot and with a low sulphur content, so that had the investigation covered forests placed in similar positions in, say the Leeds area, the results might have been very different. Unfurtunately no similar surveys have been made in other major industrial areas, and the South Wales investigation carries only the general caution that one should not assume that failure of conifers to grow well in an industrial area is necessarily the fault of smoke and fumes. On our present meagre evidence there certainly are limited areas in most of the major industrial areas where large-scale forestry could only be attempted after —and if—pilot experiments had proved that healthy growth was possible.

There are much larger areas where soot deposition is appreciable, where the hands are quickly blackened if the trees or the vegetation among them is handled. It seems very probable here that smoke may have an effect on rate of growth, or even on the visible health of the trees. But to prove this it would be necessary to collect far more data on soil, climate, and the distribution of poor growth, than are at present available. On present evidence one can only suggest that this problem of the more widespread effect of smoke and fumes exists, one cannot say how serious it is, or over what area it extends.

Leaving aside the numerous other factors, which may damage trees or restrict their growth, such as frost, drought, fungi or insects—and in practice, of course, they cannot be disregarded—the investigation of injury by polluted air is in itself one of considerable difficulty, and one often finds variations in the distribution of injury which could probably be explained only by an exact knowledge, usually lacking, of the local climatic conditions prevailing when injury took place. It seems probable that in dry air, particularly on windy days the fumes are dissipated without serious deposition taking place. Dangerous conditions exist when very fine rain is falling or in fog, when the chemical is distributed in much the same way as occurs in the modern crop-spraying technique of the distributing fungicides and insecticides as ‘ aerosols.’ Local variations in damage are often attributable to local variations in climatic conditions. It seems probable that serious damage may only take place on a limited number of days in the year, and that therefore a doubtful area would have to be kept under observation for several years before it could be decided whether or not it was fit for the growth of conifers.

Some Instances

Inevitably much of the more accurate information on injury to trees from fumes has come from court cases concerning individual factories. The classic in this line was the Traill Smelter dispute, which since the offending industry was in Canada, and the area of damage mainly in the United States, had some international importance. Most of the claims were based on damage to trees and farm crops and the settlement involved a large-scale investigation, a classic as far as the literature on fume damage is concerned, published in a volume of over 400 pages.

Cases in this country have been less spectacular, but as early as 1877 a Scottish landowner took action against an iron smelting company at Glencorse, because their fumes were damaging his forests, and obtained an injunction. More recently the fluorine emitted in the process of aluminium refining was the basis of a case at Fort William in Inverness-shire. In this case damage to forest trees was one of the main bases of the claim. Here again an injunction was granted. Damage to trees was readily apparent as much as eight miles from the factory, but serious injury was limited to a range of four to six miles up the Great Glen and up Glen Nevis, both subject to prevailing up-valley winds. On the other side of the factory the damage only extended for very short distances. Successful growth of conifers would have been impossible within about two miles of the factory on the side downwind, under the conditions prevailing when the case was started. Such conifers as did exist were dying, old Scots pine, apparently lacking in powers or recovery, succumbing with particular rapidity. The planting of conifers would have been a hazardous undertaking even within four miles on the side down-wind, and the fate of those conifers already present was very doubtful. This gives some measure of the injury that can be caused by a single large installation.

It is unfortunate that fairly accurate data of this nature are lacking for major industrial areas, or for the smoke from towns. In the absence of such data we can only assume that the health of trees and particularly of conifers within a radius of four to five miles of any large coal-burning city or any industrial community is likely to suffer to a greater or lesser extent, and to suspect that in some instances the injury, showing possibly only in a reduced growth rate may extend further afield. In practice, since high land values and other considerations tend to keep forests away from our towns, the actual area of forest subject to serious atmospheric pollution is relatively small. What is at the moment a minor though very real problem, might well become greater, unless the extension of industry into fresh areas, which is occurring in many places, is accompanied by proper considerations on fuel and plant, so that smoke and noxious fumes are avoided.

Smokeless Zones Review

The paper entitled " Smokeless Zones: A Review of the Present Position," by Arnold Marsh, read at the N.S.A.S. Scottish Conference in May, has been reprinted in full from *The Medical Officer*, and copies may be obtained from the Society's officers at 6d. each, or 4s. per dozen, post free. The reprint takes the place of the Society's older pamphlet on the subject, which is now out-of-date. It discusses the principle of smokeless zones, their advantages compared with other methods for smoke prevention, the nature of the existing legislation, zones in practice, and answers to questions that are likely to arise.

From our Photo-Library—14

Aerofilms Photo

Airman's View

(*Cement Works*)

"Lady" Hopwood of Middleton

by

Herbert Stoneley

In South East Lancashire they still talk about the redoubtable Mrs. Hopwood (1819-1906), *who waged a single-handed campaign for smoke abatement more than half a century ago.*

IF you are interested in the history of smoke abatement in might be worth while to take a trip to Middleton, near Manchester. There you would see Hopwood Hall, which is one of the beauty spots of the area, and inspect the old building, with its terraces, weathered chimney stacks, and wood, finding there wild flowers in their seasons which would be amazing for any part of industrial Lancashire except this. You would find that the hall stands on a natural eminence, and that from its terraces you can see many parts of the landscape, and in most directions, too. This is possibly the reason that Mrs. Susan Fanny Hopwood took such great interest in the question of smoke abatement, in days when to do so was to be looked upon as a crank and might bring down the wrath and emnity of the industrial barons who flourished at the peak of the industrial movement of the last century.

Looking from the mullioned windows and terraces of Hopwood Hall, Mrs. Hopwood would see mill chimneys rising in all directions. Seen from such a pleasant spot is it any wonder that anyone with a desire for public welfare would not desire to bring about some diminution of the pall which darkened the sky and injured public health?

Yet public opinion about the menace was most quiescent when Mrs. Susan Fanny Hopwood lived there. How much so can be judged by a quotation from a paper read by Dr. William Graham, Medical Officer of Health for Middleton and a great admirer of the work of Mrs. Hopwood, to the British Medical Association in 1895. He said:

" Powers were given to the sanitary authorities and the magistrates to deal with the nuisance, and whilst towns like Manchester and Salford have kept doing a little, other great and little Lancashire places (like Middleton, Rochdale, Chadderton and Royton) did nothing, or next to nothing, and all over Lancashire, where the education of public feeling is proceeding, outside a few towns no great improvement has taken palce, the sanitary authorities in some cases being indifferent, and in many their members produce it. The small penalties imposed by the magistrates and the leniency of the great unpaid has been quite inadequate to deter steam users from polluting the atmosphere, and no great atmospheric improvement has taken place . . ."

How was this to be changed? It was obvious that the public, for the public's own good, had to be educated. But how to educate the public was a question which was to take years and much hard work. On the market at the time were a number of smoke reducing appliances, yet, though it was proved beyond all argument that the use of such appliances not only saved their cost in fuel, by actually burning less coal, and producing more heat and less smoke, the mill-owners were quite indifferent to their use. It was, let us not forget, the age of " go as you please " (one could use the French term, but English is good enough), and the mill-owners resented any interference with their " rights "—though by allowing dense smoke to belch over the countryside, they did not appear to worry much about the

The Young Mrs. Hopwood
From a Painting

interference with the rights of all the rest of the community.

Therefore, a few pioneers, able to see that the main right was the right of the greater number, decided, quite without association, but on impulse, to use the Press, to tell the public through the correspondence colums of their own local newspapers, and by speaking at many meetings of various societies, to give to as large a number of people as possible the facts and figures, not simply of smoke pollution, but of its cost to health and amenities.

And in this work, leading it in her area, and inspiring a larger number of pioneers in the towns of the Lancashire industrial belt, worked Mrs. Hopwood. It was not for many years, not in fact until she had been able to show the public, against its own desires, how good and noble a work smoke abatement was, that the majority came to refer to her as " Lady " Hopwood. She was never granted such an honour. It is simply a courtesy title, but one which is an even greater honour, conferred, one presumes, by springing spontaneously from public regard.

Not that she had the honour and regard all the time. She lived in an age when it was considered that a woman's place was the home. As it was impossible to move the local magistrates and the public to do the things which Acts of Parliament gave them powers to do—a natural thing really, when one considers that many of the magistrates were mill-owners—Mrs. Hopwood at her own expense willingly paid individuals for information regarding the amount of smoke which issued from chimneys in the Middleton area. Also, so older inhabitants say, she actually employed inspectors at her own expense, though one has not been able to obtain exact information about this. The persistence of the idea, however, is so strong that there must be some truth in it.

It is, however, certain that she reported case after case, making the local magistrates deal with smoke pollution, even against their own desires; even at times seeing to it that the very magistrates themselves were prosecuted for offences which, had they been sincere, they would not have allowed.

Mrs. Hopwood also willingly addressed any society which would allow her to speak on the subject. In the " affairs " of such societies, and the minutes of Improvement Societies, the records of Debating Societies, and similar organizations, the old books show, from time to time, that there was given " an address by Mrs. Hopwood of Middleton on the question of smoke abatement."

Now in those days, when the woman's place was at home, this was indeed a brave and enlightened thing to do, and she had to suffer for her eagerness to reduce the smoke pall of Middleton and surrounding towns. There are accounts which demonstrate that the people to whom she so addressed herself did not take kindly to her efforts. As she passed through the streets of various towns, even her own, she was often told in no mean terms what the workers thought about her efforts to reduce their wages—for that was one way the employers strove to curb her efforts. " Get to your home and leave us alone," was a cry. " Let us work when we can," was another. It is on record that her carriage has returned to Hopwood Hall begrimed and filthy, for the common folk of those days (and they were common folk, and this is no exaggeration), pelted the carriage with rotting fruit, vegetables and market filth. For Mrs. Hopwood was the arch criminal, the leader of her gang of ruffians, desirous to interfere with public liberty, who " poked her nose into other people's business instead of minding her own business at home."

The Hopwood Fetes

After a time a number of the public awakened to the necessity of action, and smoke abatement Leagues were formed. It must be obvious that they would not have had the ability to do the work, the benefits of which we enjoy today, simply from the subscriptions and gifts of their few members and interested adherents. So, once again, Mrs. Hopwood took the lead in providing funds so that cases could be brought to court, and mill chimneys and other places watched, and their smoke emissions noted. To pay such persons for their information, to have inspectors, to make the magistrates do the work and impose the law, required more money. How to obtain it?

Out of such a crisis arose the famous Hopwood Fetes. The grounds of Hopwood Hall stretch considerable distances, and in them, at her instigation, were held those great fetes. At them the best runners of the day were induced to compete. In addition cricket matches were held at which the best players were seen. In this way thousands were drawn to Hopwood Hall who had little concern with smoke abatement, but once there they were informed by speeches, or by pamphlets, of the reason for these fetes, and so gradually the idea seeped into the minds of those who were either opposed or indifferent to the idea. Indeed, if you asked some of the older inhabitants of Middleton and Hopwood of the Hopwood Fetes of long ago, they would recall the days of childhood and tell you how their parents once took them along to Hopwood Hall to see so-and-so batting or bowling, or again they might inform you how as children or youths they witnessed someone beating the time for the hundred yards. They would not remember now that they paid their admission in the cause of smoke abatement. Indeed, they would be surprised to know it, and with the advances that have been made they have quite forgotten the main mover in the question, a mere frail lady, who had the courage of her convictions, and through whose efforts Lancashire was rid of much of its pall of smoke.

Mrs. Hopwood in later life

So, without stealing any credit from anyone else who may have done great work in other parts of Britain, one does hope that a little corner of praise and thankfulness will be spared to Mrs. Susan Fanny Hopwood.

(*Both portraits by courtesy of the Librarian, Public Library, Middleton*)

The Sanitary Inspector and Smoke Abatement

A Memorandum by the Society to the Sanitary Inspectors' Working Party

A Working Party was set up in July, 1951, *by the Minister of Health to inquire into the nature of the work at present being done by Sanitary Inspectors, and the nature and functioning of the present arrangements for their recruitment, training, and qualifications. One of the matters of interest to the Working Party is the training and qualification of Sanitary Inspectors in smoke abatement, on which the Society was invited to express its views. After consideration of the question by the Executive Council the following statement was submitted and was later discussed at a meeting between the Working Party and representatives of the Society.*

1. The National Smoke Abatement Society is an independent voluntary association, with an open membership, which seeks to encourage and promote the prevention of all forms of air pollution. It was established in 1929 by the amalgamation of London and provincial societies, formed in 1899 and 1909 respectively. It now has a membership that includes individuals, firms, professional and technical institutions, the national fuel and power industries, and over 400 local authorities.

2. The Society wishes to secure more effective forms of legislation than exist at present for the control or prevention of pollution, but it is also anxious that existing legislation should be used as effectively as possible. This legislation, principally that included in the Public Health Act, 1936, and the Public Health (London) Act, 1936 (containing the provisions of the Public Health (Smoke Abatement) Act, 1926—a measure pioneered by the Society), is concerned with the abatement of smoke nuisance, which is a responsibility of the local authorities, and is normally administered by a sanitary officer. New principles for smoke prevention, by the prior approval of fuel-burning installations in industry, and by smokeless zones, have been included in recent local Acts, and will, it is hoped by the Society, become general in due course. Recent legislation under the Town and Country Planning Act, 1947, especially within the scope of the Town and Country Planning Act (Use Classes) Order, 1950, has resulted in sanitary officers being called upon to act in an advisory capacity to the Planning Authorities on proposals and applications for industrial premises and their respective processes. In addition to these duties the sanitary officer is today frequently required to give general information and advice, to undertake lecturing, and to organize or co-operate in various forms of health education and publicity. This important field includes atmospheric pollution, fuel efficiency in industry, the use of improved smokeless fuel appliances in the home, etc.

3. For reasons that need not be elaborated here, we consider that the more effective control of air pollution can best be promoted if the necessary powers are retained in the hands of local authorities, or of joint committees of local authorities as provided for in the Public Health Acts, 1936.

4. If, however, effective control and progress through the agency of local authorities is to be assured, it is essential that, among other things, the administration of the law be under the control of fully qualified and experienced sanitary officers.

5. Although smoke control duties are more onerous in industrial and large urban areas, there are few parts of the country without some industrial activity, or the possibility of its

development. It is therefore desirable that all sanitary inspectors should have an adequate training in atmospheric pollution duties. In our opinion the present basic training is below the standard required.

6. A number of sanitary inspectors in industrial and urban areas who are required to devote a material amount of their time to smoke abatement, or who specialize in this work as smoke inspectors, have obtained the Smoke Inspectors' Certificate of the Royal Sanitary Institute. The proportion of inspectors possessing this qualification is however much smaller than is desirable for the effective control of atmospheric pollution, even allowing for the fact that there are undoubtedly other inspectors who do not possess the Certificate but who are directly concerned with the subject. We understand that of the 4,600 sanitary inspectors in England and Wales only 423 possess the Smoke Inspectors' Certificate, and only 25 are working as specialist smoke inspectors.

7. We are therefore of the opinion that the basic training for the statutory qualification in smoke abatement should be substantially comparable with that required for the Smoke Inspectors' Certificate and that in the statutory examination one whole paper should be devoted to the subject.

8. In relation to the recruitment and training of sanitary inspectors we are of the opinion that (largely due to the small numbers of entrants in many areas) there is a serious lack of facilities for the basic training required. Recruitment should be encouraged by improving these facilities and by giving recognition by adequate remuneration to the higher standards proposed. Further, standards should be maintained by the institution of post-qualification or refresher courses in the subject.

9. In addition to the improved basic training discussed above, there may still be a need for those wishing to specialize in atmospheric pollution prevention work, particularly in certain areas, and there should therefore be a Smoke Inspectors' Certificate of higher standard.

Summary

1. Despite other possible developments, the present form of smoke control under the Public Health Acts is likely to continue for a number of years and should therefore be made as effective as possible.
2. All sanitary inspectors should be required to possess a basic qualification in atmospheric pollution prevention work, comparable with the present Smoke Inspector's Certificate.
3. An improved Smoke Inspector's Certificate should be obtainable by those who specialize in smoke abatement work.

OBITUARY

Alderman G. E. Beavon

We regret to record the recent death of Alderman G. E. Beavon, of Birmingham, a Vice-President of the Society and Chairman of the Midlands Joint Advisory Council for the Abatement of Smoke and Atmospheric Pollution. He had a long and fine record of public service in the West Midlands, and his keenness and support for smoke abatement did much to promote the success of the Advisory Council and the newly-formed West Midlands Division of the Society.

Alderman James Griffiths

We also regret to learn of the death of Alderman James Griffiths of Cardiff, at the age of 82. "Alderman Jim," as he was known to his colleagues, had had a career at sea, starting in sail at the age of fifteen, and obtaining his master's certificate at 24. He attended a number of the Society's conferences, and those who met him will remember his racy, irresistible sailor's stories. He was Lord Mayor of Cardiff during the last war.

DAMAGE TO STRUCTURES BY ATMOSPHERIC POLLUTION*

by

T. Henry Turner

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I RESPONDED willingly to the request of Mr. A. Wade, M.B.E., the Honorary Secretary of our East Midlands Division, that I should address you on the subject of "The Damage caused to Structures by Atmospheric Pollution," because I have come to regard this subject as being of unexpected seriousness to our country.

The National Smoke Abatement Society has by now grown to represent almost every man and woman in Great Britain, who strives for the welfare of their neighbours, and for the amenities of generations to come. This is because smoke, soot, grime and sulphur dioxide are more than nuisances; they waste our time, impair our health, spoil our enjoyments, damage our property, and destroy many of the useful and beautiful things which we create.

Retrospect

In previous centuries there was never such serious atmospheric pollution and therefore no comparable rapid perishing of stone, mortar, and metal components of structures.

I was born in Stafford and remember seeing, more than 50 years ago, the neighbouring "Black Country" illuminated at night by the flickering dull red and yellow flames, which issued from the open tops of iron works blast furnaces. The burning of raw coal in domestic houses was then general practice, almost without alternative. Industrial furnaces and boilers were also fired with raw coal; gas was little used, and electricity virtually unknown. Coal was so plentiful in those days that the country prospered by exporting it. Unfortunately the "Black Country" was also a product of it.

From 1914-18, I saw little coal smoke, because I was interned near Berlin and found that Germans were far ahead of us in the efficiency of their use of fuel. Their habit of heating their homes by means of very large-sized tile covered, closed stoves, helps; because such stoves do not give the air inside the house that too-dry, burnt-dust scent which our smaller and hotter, cast iron domestic pattern closed stoves produce. Some time later, for the eight years while I was a lecturer in Birmingham University, I lived in the comparatively smoke-free suburb of Bournville.

It was not until I was appointed Chief Chemist and Metallurgist of the former London and North Eastern Railway, and went to live in Yorkshire, that the obvious harm caused by smoke and sulphur, especially in Sheffield and Leeds, and indeed throughout all the West Riding so impressed me that I commenced paying some of my own taxed money in subscriptions to the N.S.A.S. "Experientia docet," We formed a Yorkshire Division of the N.S.A.S. five or six years ago and since then we have seen smoke abatement more actively sponsored by the government, and the coal mining, gas, electricity and railway industries have all become subscribing members of the N.S.A.S.—perhaps because smoke abatement and fuel-economy are so obviously linked.

The damage caused to structures by atmospheric pollution is not so obviously linked with atmospheric pollution so we do well to consider its importance. In London, Leeds, Glasgow, Manchester, Sheffield and Birmingham, millions of children have, during three or four recent generations, grown up to think that architecture is black, and that the atmosphere always includes soot, as of necessity.

There is no law of nature demanding that soot must befoul our structures, or that sulphur dioxide concentrating into corrosive acids shall always attack our stone ornamental structures and metal creations. The soot and sulphurous fumes come from our own actions and ignorant preferences.

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*Address, slightly abridged, to the East Midlands Division of the Society at Lincoln on April 17th, 1952.

Atmospheric Corrosion Testing

In 1935 I was invited to join the Corrosion Committee of the Iron and Steel Institute and I have served on it and on its sub-committees ever since. Of one of them, the Atmospheric Corrosion Sub-Committee, I have been Chairman since its inception more than seven years ago, and thus combined studies of Atmospheric Pollution Prevention and Atmospheric Corrosion Prevention. This fact led me to write to the Director of the British Standards Institution some years ago suggesting the production of a British Standard Code of Practice for testing Atmospheric pollution, and the standardization of instruments which would be required for such tests. As a result with the co-operation of the D.S.I.R. the B.S.I. published B.S. 1747 in 1951—the first British Standard Specification for Deposit Gauges for Atmospheric Pollution. Many such gauges are already in use and it is hoped that the B.S.I. Committee will in the future obtain agreement on the use of other types of useful atmospheric pollution testing instruments.

Last year I invited Mr. S. H. Richards, who took over Dr. Meethan's important work on the country-wide measurement of atmospheric pollution, to join my Atmospheric Corrosion Sub-Committee. I am glad to say he did so, and now we have several test stations where atmospheric pollution measurements and atmospheric corrosion tests are being carried out side by side, by responsible bodies, on a long-term basis.

Such tests as these will provide scientific data for the future, but perhaps they will only confirm what I now say regarding the effect of atmospheric pollution in this country on our structures.

Effect of Atmospheric Pollution on Masonry

When Dr. W. H. J. Vernon, O.B.E., the Chairman of the Corrosion Group of the Society of Chemical Industry, heard that I was to give this address, he reminded me of a Review he prepared in 1932 of Schaffer's report on the "Weathering of Natural Building Stones." I found at H.M.S.O. that I could still purchase this 1931 D.S.I.R. Building Research Station, Watford, Report No. 18 for 4s. 6d., and doing so learnt that R. J. Schaffer had really produced a masterpiece on the subject of "The Weathering of Natural Building Stones." On pages 106 to 119, you may find there his Appendix I "Atmospheric pollution in relation to Weathering."

More recently, in 1951, R. J. Schaffer contributed to the Building Research Congress, as did Professor C. A. Lobry de Bruyn, Director, Building Materials Institute, T.N.O., Delft, Holland, on this problem of the weathering and durability of building materials in temperate climates.

It must be remembered that the softer stones are rather naturally preferred by masons who have to cut them into ornamental shapes. Unfortunately, these softer stones are often limestones and dolomites, which are attacked by acids formed from the interaction of industrial smokes and rain.

These softer stones are also rapidly weathered where there is much rain, but little smoke. The action is normally threefold; mechanical abrasion by the flow of the rain, solution by the water, and owing to the porosity of the stone, penetration by water, which expanding during frosts, cracks off portions of the stone surface. This normal weathering may be seen most clearly by half burying bricks or tiles; the frosts of one winter will often disintegrate the parts above ground level.

Acid atmosphere attacks are less important on the better granites, sandstones and well-baked bricks and tiles. Lime mortars are less stable than cement mortars. The sulphurous and sulphuric acids formed from the smokes in the atmosphere produced a skin of calcium sulphate on the surface of calcarcous stones, and this salt is slightly soluble in water (i.e., 1 litre of water will dissolve 1.9 to 2.1 gram at 20°C. of calcium sulphate).

The calcium sulphate formed on the surface is about twice as bulky as the calcium of the stone from which it was formed, so the stone appears to grow leprous.

If the stones are dolomitic the acid atmosphere attack can be more rapid, because the mixture of calcium and magnesium in the stone results in the formation of a mixture of calcium and magnesium sulphates. Magnesium sulphate is much more soluble (i.e., 1 litre of water will dissolve about 300 gram. of magnesium sulphate).

M. Camerman, the distinguished Belgian specialist attached to the Brussels University Laboratory for Stone-like Materials, who has studied the sulphation of stone exposed to smoke acids, underlines the value of washing the buildings or statues to remove the acids, and says that the more inaccessible pinnacles are often well washed by the rain. The cost of washing our buildings is worth noting so I asked the London Stone Cleaning and Restoration Co., to whom I was referred by the Building Research Station, what building washing cost us in the Festival of Britain year. Their estimation was that the amount spent on cleaning was at least half-a-million pounds.

My own reaction is that prevention is better than such cures and that the work of the National Smoke Abatement Society has only begun. We must learn how to trap the sulphur by washing the coal or scrubbing the flue gases.

York Minster

Two years ago I went with other members of the Yorkshire Division of the National Smoke Abatement Society to York Minster, and with the permission of the Dean, climbed to the top of the central tower. Looking due west from there between the two ornamental pinnacled towers which flank the west end of the Minster, one could see about a mile away the railway works, and looking south-west the close packed houses of the town almost directly below. It was clear that with the prevailing south-westerly winds the nearby town smoke or the somewhat more distant industrial smoke would sweep over the Minster. There could be no doubt that the fabric of York Minster has suffered in the past 100 years from the increasing use of coal by York's citizens and industries. Nowadays a million tons of sulphur dioxide are being set free every year over Yorkshire, and the sulphur dioxide forms acids. These have undoubtedly aided the rotting away of the alkaline stone from which the Minster is built. Mr. Hancock kindly sent me a piece of stone taken from the Minster during the recent repairs which were expected to cost £250,000, and also a piece of the new stone being used as replacement. Analysed in my laboratories these showed:

Chemical Composition	*Old stone*	*New stone*
	%	%
Silica	0.6	0.4
Oxides of iron and aluminium	2.6	1.8
Calcium oxide	32.0	54.7
Magnesium oxide	21.0	trace only
Loss on ignition	43.6	42.6
	99.8	99.5

I asked Mr. D. F. Ashford, B.SC., to try the effect of dripping dilute sulphuric acid on these stones under measured and controlled conditions and he concluded from his series of tests that:

(1) The shape of the pieces of stone attacked by the acid has some bearing on the amount dissolved. So that in parts of a building where the moisture is retained in contact with the stone greater attack by the acid results, as indeed might be expected.

(2) After the initial quick attack to dissolve the quickly soluble material, the stone dissolves away at a fairly steady rate.

(3) From the experiments he made on these two stones it appeared that the new stone should have a better resistance against the acid. This fits in with the analyses showing an appreciable content of more easily soluble magnesium in the old stone from York Minster.

Sheffield

Sheffield shows the influence of atmospheric pollution in fouling and damaging structures as clearly as any other city. Two miles from the centre of the city up-wind normally, i.e., to the west, one finds green trees: two miles down wind among the steel works of Brightside one can hardly see a blade of grass. Sheffield city lies in six valleys where the smoke tends to be held as though it were in a basin, for some of the prevailing winds pass over the hills without scouring the smoke from the valleys. Some years ago, one of my assistants photographed examples of damage to stonework in Sheffield. It was caused by the carbon, grit and sulphur in the smoke which when deposited resulted in corrosion of the buildings as well as destruction of vegetation.

In the industrial zone of Sheffield an average of over 40 tons a square mile of solid matter is deposited each month, whereas in a residential area to the south-west of the city, only 8 tons are reported. Sheffield has eight atmospheric pollution deposit recording stations and Mr. James Law, the City smoke abatement officer, recently said that Sheffield was dirtier than ever before in peacetime, and the smoke pollution figures showed substantial increases.

From the point of view of the attack on stonework in the city, the comparison of the sulphur dioxide content of the atmosphere in the centre of the town and in the suburbs is even more significant. The record shows only one milligram in the suburbs, and 16 milligrams of sulphur dioxide per square cm. per day in the industrial area. Unfortunately air pollution rises with poor coal and every householder knows only too well that the prewar grades of good household coal appear to have vanished, moreover the production of steel which has been at a high level during all the last decade has been intensified to meet post-war shortages, re-armament and export requirements. I have stood on the roof of a well-known steel works Research Laboratory on a fine day and not been able to see the centre of the town a mile away for smoke, but with the normal westerly wind this smoke blows eastward down the Don valley to dirty Rotherham, Mexborough and Doncaster.

Salisbury Cathedral

Lest you should think that such damage to buildings is the normal thing, let me remind you of that Jewel of Architecture, set in the centre of a wide green grass circle, Salisbury Cathedral, with the loftiest spire in England and virtually no atmospheric pollution.

In 1945 some concern was felt by the Consulting Architect, the late Mr. W. A. Forsyth, about the corrosion of wrought iron reinforcement bars used to strengthen the tower and spire of Salisbury Cathedral. This led to an inspection of the structure in May, 1946, by Dr. J. C. Hudson and other members of the Atmospheric Corrosion Sub-Committee of the British Iron and Steel Research Association, together with myself as Chairman. As a result the following observations and recommendations were made.

The 13th century structure over the crossing finished at the main roof level in the form of an arcaded lantern with walls 6 feet thick but having a two-foot passage in the centre of the thickness. The tower and spire were added in the fourteenth century on this hollow wall which has been strengthened at various times to enable it better to support the additional weight. The necessary strengthening has been effected as follows:

(1) In the 14th century, at the time the tower and spire were added, the builders strengthened the stonework at the base of the spire by inserting wrought iron bars 1½ to 2 in. square. These were placed on the inside of the walls and partly embodied in the stonework.

(2) Round about 1685 Sir Christopher Wren added some further wrought iron bars about 2 in. square.

(3) In 1869 Sir Gilbert Scott added four tiers of diagonal wrought iron ties at the lantern level, each built up from four bars approximately 5 in. by 1½ in. These ties grip the walls of the angle staircases.

(4) In 1939 Mr. Forsyth further strengthened the structure by inserting rods of Delta metal (a high tensile bronze) and by having the four spiral staircases in the angles of the lantern bricked up.

Lincoln Cathedral wall, showing deposits and erosion. Photograph taken during the Divisional visit

All the wrought iron reinforcements were found to be in excellent condition inside the building and serious corrosion was only found outside, where moisture had been retained in contact with the metal. For example, some of the 14th century wrought iron at the north-west corner had been sheathed in lead where it left the stonework. The lead had become loose and permitted the lodgement and retention of water. The iron had been severely attacked and had to be replaced. Again the lowest of the four 1869 bars had been set in a stone buttress with a sandy and too porous concrete. Moisture had thus been retained in contact with the iron and rusting had occurred.

There was, however, no evidence of any difference in the resistance to corrosion of the three wrought irons dating, respectively, from the 14th century, 1685 and 1869. As already stated, under dry conditions inside the building the wrought iron had virtually not rusted at all and appreciable rusting had only occurred outside under certain conditions where water had been retained in contact with the metal, or where the metal had been exposed in a rainwater course.

The remedial measure suggested by the Atmospheric Corrosion Sub-Committee had as their main object the prevention of permanent contact of moisture with the iron. This has been done by providing runways of lead or of waterproof concrete for the rainwater, placed so as to prevent it running on to the iron. Certain protective measures such as the use of sprayed zinc coatings on the old iron are also under consideration, and if any further reinforcement bars have to be added, they will be made of high tensile bronze.

Shortage of Sulphur and Metals

When Dr. U. R. Evans, F.R.S., Reader in the Science of Metallic Corrosion in Cambridge University, was told that I was to speak on "Damage to Structures," he reminded me of what he wrote to *The Metal Industry* last year regarding the extraordinary anomaly that while everyone was discussing the shortage of sulphur no one seemed to be mentioning the surfeit of sulphur in the wrong place.

Parliament has been informed that we should be short by 19,000 tons of sulphur, and yet Dr. A. Parker, C.B.E., Director of the Fuel Research Station, has shown that during the years immediately preceding the war, the annual pollution of our air was 5 million tons of sulphur dioxide, that is 2,500,000 tons of sulphur.

The trends published by the D.S.I.R. suggest that sulphur pollution is increasing in about as many places as it is decreasing. Sulphur enters the air as sulphur dioxide or trioxide when fuel is burnt but is to a considerable extent deposited as ammonium sulphate, which Dr. W. H. J. Vernon has shown to be the most destructive constituent of urban dust; the corrosive effect is greatly accentuated by the presence of SO_2.

We are not short of sulphur only, but also of zinc, lead, nickel, and other metals, and there is little doubt that whereas a thin and relatively porous coating of nickel might suffice to protect sulphur-free steel from a sulphur-free atmosphere, a much thicker coat, involving far more expenditure of nickel is needed under the conditions which now exist in our country, thus the seriousness of the shortage of nickel for example is closely bound up with the surfeit of sulphur in our atmosphere.

If fuel could be freed from sulphur before it is burnt we could protect steel with a small consumption of zinc, lead, aluminium, or nickel, whether in the form of metals or in the form of pigments in a coat of paint.

Dr. Evans has also told me that he thinks we may have placed too much emphasis on the iniquities of soot and rather overlooked the iniquities of sulphur.

There is much damage being done inside buildings at the present time due to gas heating devices in which gas is burnt without the provision of a flue. Last year I was asked to examine an almost new electronic organ which had gone out of commission through corrosion, which was accelerated by the fumes from gas radiants. Even if the coal gas has been freed from all sulphur compounds, and the removal of some of the organic sulphur compounds is not commonly carried out today, condensation of moisture produced by the combustion of gas in the building sets up appreciable corrosion of expensive fittings and components.

Effect of Atmospheric Pollution on the Corrosion of Metals

The short answer is that all our leading experts in atmospheric corrosion agree, that atmospheric pollution by soot and sulphur compounds from the combustion of coal accelerates the destruction of our metal articles, mechanisms and structures.

Thus atmospheric pollution corrodes steel and non-ferrous metals—latches, locks, hinges and structural members, and prevents the economical use of light alloys in industrial areas. Brickwork, stonework, cement, mortar and asbestos cement, all suffer damage accelerated by atmospheric pollution. Inside the buildings chimney soot is a foul nuisance, radiators "mark" the walls, ceilings become dirty and show the filter effect of the plaster, windows steam over and collect grime, defeating their object.

That is the problem: architectural, industrial, domestic, all around you. To whom do you turn for help? Why not to yourselves, for nothing will be done to reduce atmospheric pollution unless we do it.

Experiments in progress at the National Physics Laboratory of India, at Delhi, on the concentration of solar energy by curved mirrors recently enabled the Prime Minister, Mr. Nehru, to eat food that had been cooked in this way. It is stated that a temperature of 1,500° C. is attained at the focal point. Russian claims in this field are the operation of steam boilers and even of operating an entire canning factory.

Pasadena Symposium

Reference List of Authors and Papers

The 2nd National Air Pollution Symposium, sponsored by the Stanford Research Institute, was held in Pasadena, California on May 5th and 6th, 1952. Abstracts of the papers have been received but are rather too long for complete publication. The titles and authors, listed as follows, provide, however, a bibliographical reference to the proceedings of this important conference.

Session I—Our Knowledge of Atmospheric Pollutants

The Nature of Atmospheric Pollution in a Number of Industrial Communities, by Cholak, K.

The Status of the Development of Instrumentation for the Study of Air Pollution, by Thomas, M. D.

Session II—Fundamental Chemistry and Physics of the Atmosphere

Chemical Reactions in Los Angeles Smog, by Cadle, R. D. and Johnston, H. S.

Some Aspects of the Physical Behaviour of Aerosol Particles in the Atmosphere, by Ranz, W. E., and Johnstone, H. F.

A Fluorescent Atmospheric Tracer Technique for Mesometeorological Research, by Perkins, W. A., Leighton, P. A., Grinnell, S. W., and Webster, F. X.

Some New Developments in Micrometeorological Studies of the Atmosphere, by Church, P. E.

Session III—Combustion as a Contributor to Air Pollution

The Composition and Nature of Blowby and Exhaust Gases from Passenger Car Engines, by Payne, J. Q., and Sigworth, H. W.

Hydrocarbon Constituents of Automobile Exhaust Gases, by Magill, P. L., Hutchison, D. H., and Stormes, J.

Products from Combustion of Gaseous Fuels, by Hall, E. L.

Session IV.—Biological Aspects of Air Pollution

The Detroit-Windsor International Programme—A Scientific Approach to the Study of the Influence of Air Pollutants on Community Health, by Katz, Dr. M., Frederick, Dr. W. G., and Clayton, Dr. G. D.

The Development of Fluorine Toxicosis and its Effect on Cattle, by Phillips, Dr. P. H.

Life Processes of Plants as Affected by Air Pollution, by Hull, Dr. H. M., and Went, Dr. F. W.

Anatomical Effects of Air Pollution on Plants, by Bobrov, Dr. R. A.

Publications from the U.S.A.

We have received, among other papers, the August issue of *Air Repair*, which has 48 generously-illustrated quarto pages, all of editorial matter. Among many personal paragraphs is an account of our Past-President, Dame Vera Laughton Mathews, headed " English Anti-Smoke Leader was Admiral."

Sumner B. Ely, Pittsburgh's well-known Superintendent of Smoke Prevention, has sent us his 1951 *Report on Stationery Stacks.* The city's monthly pollution figures for the past seven years show a remarkable improvement. There has, over this period, been a decrease of hours of total smoke of 67 per cent., or if heavy smoke only is considered, of 77.3 per cent. During the heating season the decrease in total smoke is 84.8 per cent., or for heavy smoke 94.8 per cent. Congratulations, Pittsburgh!

The *Second Technical and Administrative Report on Air Pollution Control, Los Angeles County*, for 1950-51, has a great deal of valuable information about the nature and behaviour of the pollution in the area. (See also Abstracts 193 and 194, on another page). Since beginning their work in 1948 the District organization has given prior approval to 50 million dollars worth of equipment. The cost of the District's operations during the year under review was 461,000 dollars.

The Third Report of the Allegheny County Bureau of Smoke Control, by the Director, Thomas C. Wurts (a member of the N.S.A.S.) is an impressive statement of progress in one of the world's most heavily industrialized areas. Pollution from iron and steel plant is a major factor, and it is interesting to see how the policy of co-operation with industry making it possible to stimulate research and what is called " self policing," is bringing results. There has, for example, been a decided reduction—75 per cent.—in the number and intensity of blast furnace slips as a result of greater care in operation. " This in turn," it is said, " has been rewarding to the steel companies by improved product resulting from this decreased frequency of slips." More lengthy than the report itself are appendices reporting on research being undertaken by the steel industry, burning gob piles (spoilbanks) and on steam locomotive fly ash.

Correspondence

A MISLEADING QUOTE

The Editor,
Smokeless Air

Sir,—In the summer issue of your excellent publication you quote from an article in the *Sunday Chronicle* on page 161 with reference to the smokeless zone in central Manchester. I would like you to make it clear to the readers of the magazine that the main space heating load and domestic hot water supply in these offices is taken by solid fuel. In view of the introduction of a smokeless zone we provided ourselves with coke-fired boilers, and in fact use our own hard coke from N.C.B. ovens at Altham. The National Coal Board is therefore fully supporting the recommendations of the Simon Committee. When we considered the question of central heating we found the cost of gas-fired boilers would be very considerably greater than that for solid fuel.

W. H. CARROLL,
Deputy Marketing Director.

National Coal Board,
40 Portland Street,
Manchester, 1

CORBY COMPLAINS

The Editor,
Smokeless Air

Sir,—During 1951 the Urban District Council of Corby pressed for a more virile and active approach to the problem of atmospheric pollution (in its widest implications), and they were gratified to receive ample evidence of support from many Local Authorities distributed throughout the country. It became apparent that the Executive Council of the National Smoke Abatement Society had misgivings regarding the purpose of the campaign, which to some extent was taken as a reflection upon their sincerity. That impression was quite erroneous, and this Urban District Council told the Executive so, and as an earnest of their endeavours submitted, for the prior approval of the Chairman and General Secretary, a draft of the resolution proposed to be moved at the Annual Conference. The terms of the resolution were, in fact, approved and are repeated below:

> " In order that the problems connected with atmospheric pollution arising from industrial processes may be vigorously tackled, the National Executive be instructed to make a thorough survey of the present position, and of the difficulties involved, and to this end consult with the industries concerned, with the national associations of local government authorities, government departments and other societies and associations whom the executive may consider are interested in the subject; and at the earliest possible date issue a comprehensive report of their investigations, together with long and short-term policies for reducing and ultimately eliminating such pollution."

It will be noted that the resolution is

drawn in wide terms and is not in any case restricted to pollution arising from the iron and steel industry, which is the particular concern of Corby.

At Blackpool, however, the Chairman stated that the Executive Council had ruled that the resolution should not be moved at that Conference, but should form the subject of a session at the next annual conference.

The deliberations of the Technical and Conference Committees on the resolution have now been completed and the result is that four specific items, essentially connected with the steel industry, are to be discussed at this year's conference.

The support given to this Council's efforts, and to which reference is made above, was not confined to Local Authorities concerned only with pollution arising from iron and steel processing, and this Council has informed the Society that in its view the outcome of the reference of a comprehensive resolution can be regarded only as a thorough distortion of the objects sought and they deplore the decision of the Executive Council, which will have the effect of restricting the discussion to one particular aspect of the problem and which ignores completely the request for the Society to formulate a policy for the ultimate solution of the whole problem This Council must, therefore, dissociate themselves from the proposal and they have asked the Society to make their disappointment clear by notice:

(*a*) published in *Smokeless Air*;
(*b*) attached to Conference papers, and
(*c*) referred to at the Conference session.

The Society's decision, which was requested on March 7th, 1952, has not yet been conveyed to this Council, hence the need for publishing this statement. This Council will continue to use every endeavour to secure a more vigorous approach to the solution of the problem of atmospheric pollution from whatever source it may occur.

Kenneth H. Turner,
Chairman
G. B. Blackall, *Clerk*.

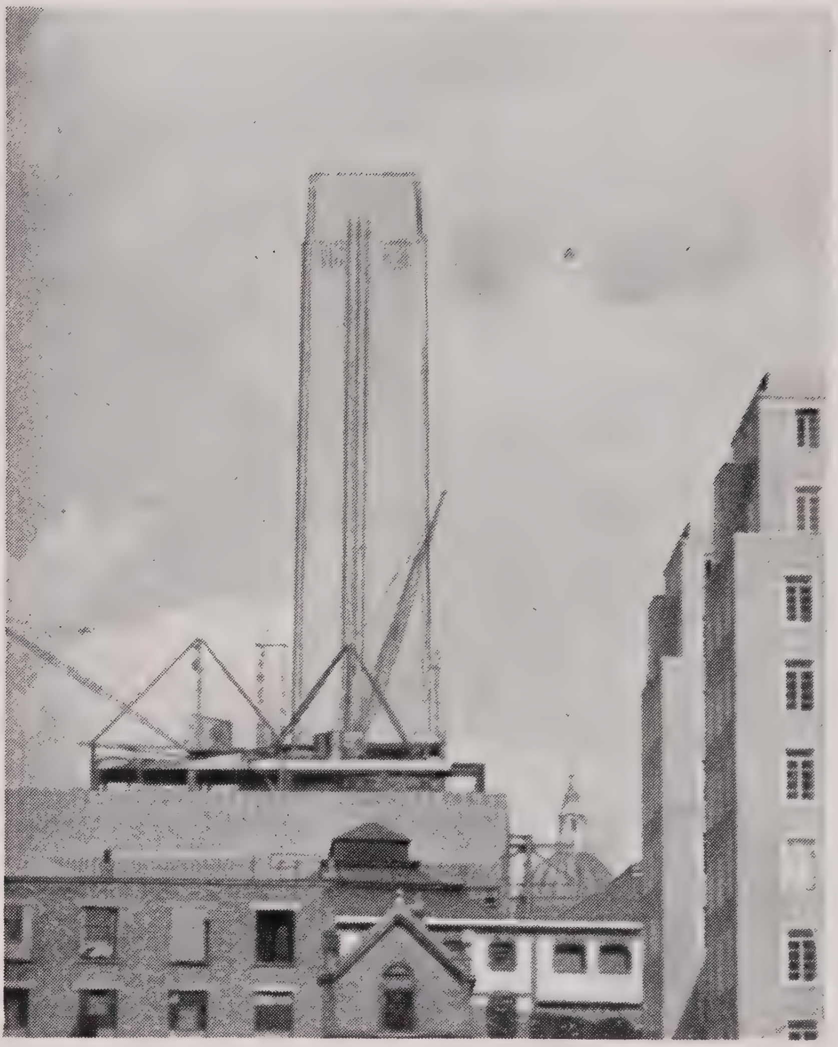
Corby Urban District Council.

(In the hope of a more co-operative attitude from the Corby U.D.C. we have not hitherto discussed the many difficulties they have caused to the Society. On the above letter, however, it should be stated that the Executive Council did not agree that the resolution quoted should be the subject of a session at the next conference, but only that this should be considered. It has, in fact, been very carefully considered by the Officers, the Conference and Technical Committees and the Council itself. The consensus of opinion may be summed up as being that the survey demanded in the resolution would be far beyond the powers and resources of the Society or any other body short of a Royal Commission, and would in any case add little to what is already known. Therefore, to attempt to discuss such a project, and the air pollution problem in its entirety at a single conference session would have no practical value. It was, however, agreed that it would be useful if future conferences were to examine individually some of the outstanding technical problems, and that a start should be made with iron and steel manufacture.

In this, and in other questions, Corby U.D.C., though remaining a member of the Society, has most regrettably been unable to accept a policy that is based on the long and wide collective experience of its Executive Council and other members, and which must be related to the resources available. The sincerity of members has undoubtedly been questioned, even publicly in the local Press, which has also, for example, on statements by Corby's representative, described the Society as their biggest stumbling block in the way of smoke abatement !
—*Editor*).

After Greenwich—Johannesburg

We have told how London's smoke has driven the Royal Observatory away from Greenwich to Hurstmonceux in Sussex. Now comes the news that the Yale-Columbia Southern Station Observatory has been obliged to move from Johannesburg to Mount Stromlo, in the Australian Alps, 12 miles from Canberra. The photographic work done with the 26-inch refractor telescope is largely on the measurement of light from the stars, for which a wide field of vision and a clear atmosphere are necessary. The dust and smoke of Johannesburg are cited as one of the main reasons for the removal.



Bankside Chimney

The stately new tower-like chimney of the much-discussed Bankside Power Station, now nearing completion, seen from the south. The Station will burn oil and its flue gases will be washed to remove sulphur acid gases, because of the proximity of St. Paul's, the dome of which, across the river, can just be seen.

The Minister of Housing and Local Government had confirmed a Warrington byelaw relating to the emission of black smoke from industrial premises.

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Twenty-nine residents of White Plains, New York, are each claiming £10,000 damages from the New York Central Railroad on the grounds that soot and smoke from carriers' yards and coal-burning locomotives are making life miserable. The damages claimed are for discomfort caused during the past ten years, and for cleaning, repairs and cost of extra domestic help.

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Mr. C. A. Pennington, of Widnes, has passed the Liverpool University Sanitary Science Committee's examination in Fuel Economy and Smoke Abatement, at the age of 63. Although due to retire next year he is now planning to sit for the Smoke Inspector's Certificate of the Royal Sanitary Institute.

The New "Alkali Report"

88th Annual Report on Alkali, etc., Works, by the Chief Inspectors. Proceedings during the year 1951. H.M. Stationery Office, 2s. net.

The new Report is, as usual, a mine of interesting and important information about the prevention of atmospheric pollution in the industries that are the particular concern of the Alkali Inspectorate. It is stated that the number of registered works is decreasing, because smaller works have been absorbed in larger ones, which are becoming bigger and even more complex. More time is needed for inspections, and much time is also taken up in visiting unregistered works. This means that the number of inspections of registered works has been reduced, a trend that can only be reversed by appointing an additional inspector or "by curtailing quite severely the attention given to non-registerable processes."

We hope that the latter alternative will not be necessary, for the Report shows very clearly the importance and variety of this part of the Inspectors' work. In the "unregistered" section there are spoilbanks, electricity generating stations, other steam-raising plants of various kinds, industrial furnaces, coke ovens, gas and low temperature carbonization works, metallurgical works, lime-burning, etc., brickworks, and so on. The registered works discussed include cement, alkali, sulphuric and other acids, chemical manure, gas liquor, and other works. Each process, often each individual plant, has its own peculiar problems, demanding an individual approach. Even to list some of the items in this way gives an indication of the remarkable complexity of the problems of atmospheric pollution in this country.

It is impossible to discuss or quote the many sections of particular interest that will be found in the Report, but mention may be made of the information on the flue gas washing plant at Battersea Power Station, and of the question of burning spoilbanks (in the England and Wales report; "bings" in the Scottish). The number of spoilbanks giving rise to either "much" or "slight" smoke or fumes show little change from the previous years.

Brief Reviews

One of the best short accounts of the heat pump we have seen is an article written by a member of the Society, Mr. V. A. Carpenter, and published in *The School Science Review* for March, 1952. The article has been reprinted in pamphlet form by the publishers, John Murray Ltd.

The Society is frequently asked for information or advice on air pollution arising from crematoria, and we have been interested to see a short illustrated brochure on *Gas in the Service of Cremation*, published by the Gas Council. Of the 130 cremators operated by the 62 cremation authorities in Great Britain 106 are gas-heated.

Those interested in fuel problems—production, supply, price, etc.—will find much of interest in the *Annual Reports*, for the year ended June 30th, 1952, of the *Industrial and Domestic Coal Consumers' Councils*. Both reports are included in the one publication, which is published by H.M. Stationery Office at 9d. net. Price structure questions and question of coke and boiler fuel availability are discussed and are matters of importance from the smoke prevention viewpoint.

NEWS

Yorkshire Division at Halifax

A meeting of the Yorkshire Divisional Council was held at Halifax on July 21st. Dr. G. C. F. Rose, Medical Officer of Health for Halifax, gave a short statement on atmospheric pollution and carcinogens, and Mr. H. Margerison, Chief Sanitary Inspector, made a statement on atmospheric pollution in the town. Later a visit was made to inspect the cooling towers of the B.E.A. station in Halifax, from which a previous nuisance of moisture precipitation in the neighbourhood had been eliminated. Mr. H. E. Vickers explained the nature and effects of the newly installed eliminator—one of the first plants chosen to have this new device fitted. He said that experiments and research had proved that the discharge of moisture was not due to condensed steam but was due to circulating water carried upwards by the excess speed of the gases. Once the real cause was found the remedy was simple. He described the simple design of the eliminator plates and how effective they were.

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Tees-Side Committee

At a meeting of the Committee on June 19th an address was given by Mr. J. S. Hales of the British Coal Utilization Research Association on the domestic smokeless burning of bituminous coal. He stressed that domestic heating involved house construction in addition to appliances, and insulation in particular. The greatest offender in producing atmospheric pollution from domestic fires was undoubtedly the open fire. Experiments had been made at the Research Station but no practical economic method of burning bituminous coal without pollution had been found. It had been advocated that we should go over to the closed type of stove, but Mr. Hales thought that this was not necessarily the best method. While the air was adequately heated and circulated by convection there was very little radiant heat. For convection heating to be successful fairly high temperatures had to be maintained. This was most satisfactory with insulated houses, but was not likely to be so successful with houses which were not insulated.

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The Directors' Report and Accounts for the year ended March 31st, 1952, of Coalite and Chemical Products, Ltd., show that the year was a record in the history of the company. Trading profit increased to £713,029 from £461,131 the previous year. All plant operated to capacity, and a new battery of retorts was commissioned in October last, while a new battery is programmed for building. For efficiency and economy a new Head Office has been built at Bolsover, in which all departments, other than the southern sales office in London, will be housed.

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The July issue of *Fuel Efficiency News*, the bulletin issued by the Ministry of Fuel and Power, contains a short article by one of our own members, Mr. John Fox, on " Fuel Efficiency in the Heavy Clay Industries," and an account of the " smoke lights " that can be fitted into the side flues of Lancashire boilers, although they were developed for oil-fired marine boilers. They consist of an ordinary electric light shining through a hole in the uptake to a sight hole on the other side. A mirror is sometimes used as a periscope to reflect the light down to the stokehold floor. When the bulb can be seen clear and bright there is no smoke but there may be excess air. Perfect combustion is shown when the light appears hazy and flickers slightly but is still visible. Smoke causes a blackout.

Pollution from Buses

In a press interview a London Transport official has criticized a figure given in the contributed article on electric vehicles that was published in our Spring, 1952 issue. The article stated that London's central area buses emitted 31,000 tons of soot into the air each year. It is said that this is fantastic, and would mean a large sackful of soot each day. We have tried, but have not been able, to obtain information about how the figure was arrived at. It is, however, interesting to note, as mentioned elsewhere in this issue, that recent investigations in California show that in Los Angeles County well over 100,000 tons a year of hydrocarbons and aldehydes are emitted from the exhausts of road vehicles.

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Mr. Royle, M.P. for Salford West, asked the Minister in the House on July 29th on what grounds the Salford City Council had been refused permission to extend their system of smokeless zones; and if the matter could be considered. Mr. Marple replied: " My right hon. Friend has decided not to confirm the Salford Smokeless Zones Order after a public local inquiry and having regard to practical difficulties in connection with the conversion of existing methods of heating. He cannot reconsider the matter at present."

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A particular parcel of air as it moves through the atmosphere will scatter and diffuse into an area one million times its original size before it has gone ten miles. This takes place in as short a time as two hours.

This was the discovery of three scientists at the New Mexico Institute of Mining and Technology who " tagged " air with minute fluorescent pigments and then followed with aeroplanes their travels through the sky. A report was given of this work by Dr. W. D. Crozier to a meeting of the American Meteorological Society recently.

The writer of the " Diary of a Sanitarian " in *Municipal Engineering and Sanitary Record* refers frequently to his interest and activities in smoke abatement. He wrote recently: " Looking through an old report of December, 1905, I noted that 68 smoke observations had been taken during the period under review. Periods of observation amounted to one hour in each case. The highest emission of black smoke was 43 minutes 40 seconds. Seven chimneys showed emissions of black smoke in excess of 30 minutes, and 22 had emissions of black smoke ranging from 20 to 30 minutes. In only one case was the emission under two minutes, the actual figure being one minute fifty seconds. Looking back on those days the National Smoke Abatement Society and Sanitarians generally can be satisfied that very real progress has been made in the intervening years."

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A Bill, sponsored by Rep. James J. Murphy (N.Y.), unanimously passed by the House of Representatives, Washington, on June 2nd, and sent to the Senate, instructs Government agencies investigating air pollution problems to intensify their activities and authorizes the appropriation of additional funds for this purpose. It calls for additional research and investigation of prevention and control measures to be taken by the Surgeon General, the Secretary of Agriculture and the Secretary of the Interior. It was estimated that it would take five years to complete the programme and would cost upwards of 100,000 dollars a year.

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An uncommon reason for complaining about smoke comes from a clerical resident of Bradford, who signs his letters to the local paper as " The Sporting Parson," and who on this occasion is indignant that smoke from a factory chimney is spoiling his early morning run.

The Mobile Testing Units

of The Ministry of Fuel and Power*

by

W. Short

Fuel Engineer, Scottish Regional Office

NO description of the Mobile Testing Unit services would be complete without outlining all the services available to industry that are provided by the Fuel Efficiency Branch of the Ministry of Fuel and Power.

First, the Ministry have in each region a number of skilled demonstrators, who are capable of instructing firemen in the correct methods of firing any type of boiler plant. This instruction is given on the firm's own plant. In addition, these demonstrators are available to give advice and demonstrations on eliminating smoke nuisance from factory chimneys, and most Local Authority sanitary inspectors will be familiar with this side of the Ministry's work.

Next, there are trained fuel engineers, who are available to firms, no matter how small, to inspect their plant and advise what economies can be made on boilers, power and process plant, furnaces or kilns, either in the method of operation, or in improving and modifying the plant. In addition, a section of the Ministry's staff gives advice to the manufacturers of domestic solid fuel heating and cooking appliances, and are available to assist in bringing appliances up to the required standards of performance for inclusion in the lists of approved appliances issued to Local Authorities, by preliminary testing and suggesting modifications.

The third service available is the Mobile Testing Unit service. The earlier work of the Ministry's staff, during the war period, was mainly concerned in assisting firms to maintain production, often with fuels of poorer quality or with different properties to the grades firms were accustomed to use. Gradually, as engineers were able to give more detailed attention to individual firms, it was realised that visual inspection of plants and the use of portable indicating instruments did not always enable really comprehensive advice to be offered. Engineers could, and did, give very valuable advice on what might be termed the " obvious " points requiring attention, such as insulation, correct methods of firing, smoke abatement, steam trapping and condensate return, and so on. However, without much more detailed information on the performance of plant such as boilers, furnaces, engines, driers and other process plant, it was found very difficult to determine the best methods of improving their performance and thus saving in fuel. It was realised that this essential information could only be obtained if a large number of recording instruments were available.

As a result in January, 1949, the first experimental Mobile Testing Unit began carrying out heat balance tests at selected firms where it was known that much had already been done to attain a high standard in fuel efficiency. The results obtained exceeded expectation, as even in factories where attention had already been given to fitting instruments, the detailed surveys made by the Unit revealed hitherto unsuspected sources of loss. It was found that an average saving of 15 per cent. was possible using the information provided by the tests on these first few firms.

The success of this experiment in " bringing the laboratory to the factory " was so pronounced that the service was placed on a permanent footing and three additional Units were brought into service. One of these has been in operation in Scotland since March, 1950, and in the first twelve months, it surveyed 19 firms.

Experience showed that, while this large Unit was ideal for the larger firms, smaller firms required a different type of service on a less elaborate scale, and on March, 1951, the Mobile Testing Unit Service was extended to enable small firms to receive assistance, and also to enable firms to have tests made, using the latest instruments, on individual items of plants or boilers as opposed to a full survey.

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*From a Paper read at the Annual Conference of the Scottish Division, N.S.A.S., at Perth on May 22nd, 1952.

The large Mobile Testing Unit

The Mobile Testing Unit itself consists of a converted ex-R.A.F. Radar Van, equipped with several thousand pounds worth of indicating and recording instruments. One side of the van is fitted with an angle iron framework on which are mounted instruments in aluminium panels made identical in size and drilling so that the instruments panels can be removed and mounted on special brackets when tests are being carried out at a works. By this method, instruments can be taken right up to the particular piece of plant to be tested. The instruments include temperature recorders and indicators with various ranges up to 1,600°C.; surface and optical pyrometers; steam meters of the shunt, orifice and pitot types; water meters; pressure indicators and recorders with ranges from 0.1 inches water gauge to 300 lb. per square inch; indicating and recording draught gauges. A velometer, avometer, multi-range ammeters, engine indicators, tachometer, gas and water testing equipment and many other small instruments are also carried. In addition, and extensive range of tools is carried to enable all normal fitting work and adjustments to be made by the staff of the Unit. Also for very large firms, or for unusual problems, additional equipment can be drawn as necessary from a central " pool " serving all four Units.

Usually the survey starts at the boilers and power plant and a continuous test is run for up to 168 hours, depending on local conditions. Next, the heat and power requirements of each section of the process are determined. This is done either by following through the process in the normal order of material flow, or by dealing with each section in turn and collating the results afterwards. When a full survey is made, all classes of plant are reviewed, namely, driers, furnaces, kilns, vats, gas producers, hot water storage systems, space heating, air conditioning and electricity utilization.

The Ministry Units require considerable expenditure on them, not only in initial equipment, but also in the careful

One of the Mobile Testing Unit Vans

maintenance and renewal of instruments to ensure the utmost accuracy. In view of the financial benefit due to fuel savings obtained by users of the service, it is only appropriate that they should make some contribution to its cost, so that this does not fall on the public purse. Firms will be asked to make a contribution to cover maintenance and running costs of £15 for each day on which the Unit is actually testing their plant. This figure is the present cost, although it may be subject to alteration at some future date.

The Small Mobile Testing Unit

To enable the same service to be offered to the smaller firms as the Large Unit offers the firms with either complicated plant or large fuel consumption (50 tons per week or more), the Ministry have now obtained a second set of indicating and recording instruments, similar in type and capacity to those fitted permanently on the Large Unit.

These instruments are kept in a central store and for surveys at smaller firms, a small van is used to transport instruments from store to firm, the number and type depending on the size of the firm's plant and the type of work to be carried out.

A considerable variety of work can be carried out by this Small Unit. For example, complete surveys can be carried out at small firms in the same manner as the Large Unit. Again, one particular problem can be investigated, possibly occupying only a single day, such as an efficiency test on a small boiler, or metering of steam to one or two items of plant.

In view of the variety of work that this latest extension of the Mobile Testing Unit Service can perform, a different system of charging is used, based on the number of Ministry engineers engaged. The charge is £5 per working day for each member of the Ministry's staff working on the particular survey or problem. For example, an investigation of either quite a small firm, or relatively small items at larger firms, could be carried out by a single Ministry engineer with the aid of the firm's engineer or fitter, so that the charge would be £5 per day. For more detailed surveys, especially at medium-sized firms, two engineers might be needed. It should be noted that the maximum charge is £15 per day, although this would only be necessary for surveys similar in scope and the number of instruments used to those carried out by the Large Unit.

The Units are staffed by expert fuel technologists with many years' combined experience in fuel and steam utilisation and any information obtained during a survey is treated as strictly confidential and firms may be assured that no information from a survey would be made public without their consent.

Any firm expressing interest in these services would receive a preliminary survey by a Ministry engineer, without any charge or obligation to ensure that the Uunit can be of real service. During this preliminary survey, an inspection is made of the firm's plant, and note is taken of any special advice required on particular problems. The firm is then advised whether or not a Mobile Testing Unit would be of real service to them, and an estimate of the number of days that a survey would take would be given. Should the firm then decide to book the Unit, the Ministry engineer who will run the survey usually spends several days before the arrival of the Unit, planning the lines on which it will run and arranging for any necessary fittings and tappings to be made so that no time is wasted once the Unit arrives.

After tests have been run under normal production conditions, the possibility of improving thermal efficiency is explored. Changes in method may be suggested and, often, as a result, other improvements such as better material throughput and greater uniformity of product are achieved.

On completion of all the tests, the results are checked and a report is prepared. The existing conditions and test results are clearly stated and supported by relevant drawings and graphs. Analysis of these data usually enables recommendations to be framed which offer both financial benefit and improved fuel efficiency. The report is sent to the firm for their comments, and any questions raised by them are answered. It is then left to the firm to carry out such of the recommendations as they think desirable. All reports are treated as confidential.

There is one last point, and that is in connection with Consulting Engineers or Fuel Technologists. It is not intended that the Ministry's Mobile Testing Unit Service should be in any way competitive with their work, but rather complementary to it. Indeed, in many instances, the report made by the Ministry will doubtless lead firms to seek the advice of consulting engineers and in such circumstances, at the request of the firms, the Ministry's engineers will be ready to enter into discussion on their findings with the firm and their consultants.

Firms desiring further information, or a free preliminary survey to advise whether the Unit could be of service, should contact the Ministry of Fuel and Power at the appropriate Regional office. There is also an extremely good paper by Messrs. Price Walters and Clegg which was given to the Institute of Fuel on March 18th, 1952.

It should be noted that the services of Ministry engineers to give advice on methods of fuel efficiency, surveys of plant not involving the use of instruments, and demonstrations of correct firing methods or the utilisation of different fuels are still absolutely free of charge.

Some Results

Now you will naturally be interested in the results obtained by the Mobile Testing Unit Services. Up to December 31st, 1951, a total of 125 surveys, varying in length from four days to six weeks, were carried out by all the larger testing units in Scotland, Wales and England and the actual average fuel saving shown possible was 20·8 per cent. You will, of course, be especially interested in the Scottish position, and the following figures may be of interest. The results of surveys carried out on 45 firms in Scotland up to the end of December, 1951 show that the percentage of fuel that could be saved was 26 per cent. These firms between them consumed nearly 330,000 tons of coal per year, based on the usage at the time of the surveys, and the possible saving thus amounts to 84,500 tons each year.

One of the largest firms visited in 1951 was a paper mill consuming 470 tons of coal per week, at which the survey showed a possible fuel saving of 24.5 per cent., or 115 tons per week, was possible. A typical example of the work done by our smaller unit was the case of a small engineering works burning 20 tons of fuel each week, where a saving of 38 per cent., or 7½ tons per week, was shown possible.

It will be appeciated that the possible benefit of these services to Scottish industries is very great indeed, and it can also be seen that the cost of a survey is rapidly recovered. Normally the saving in fuel recovers the cost within a few weeks. The industries covered by these savings include paper-making, breweries, flower mills, biscuit factories, engineering firms, dyeing, finishing, woollen and other textile industries, brickworks, laundries, chemical factories, tyre and rubber factories, fish meal manufacturers, linoleum works and ropeworks.

Inside one of the Vans

Two case histories illustrate the type of work in which our Units can offer a unique service, and I would thank the management of these firms for their permission to publish the following accounts.

Messrs. Brown & Adam Ltd., Glasgow

This firms of textile dyers and finishers were shown by running trials on a cloth dye-box, first as found and secondly when fitted with an enclosure hastily knocked up by the firm's joiner, that the enclosure reduced the steam consumption on the dyebox by 38 per cent., while at the same time, to the dyer's delight, the penetration and evenness of colour of certain shades was improved. This, if applied to all the dyeboxes, was shown to save 76 tons of coal per week and at the time of writing half the boxes have been enclosed and the remainder are awaiting conversion. As a longer-term policy thermostat control is to be fitted which will save further fuel.

In the drying department almost all the cloth drying plant was modern, yet although it appeared from a visual inspection to be in excellent condition, the Ministry tests showed that 9 tons of coal per week could be saved by minor alterations in air flow, fan damper positions and sealing of openings. The space heating arrangements were also examined and it was shown that the installation of thermostat control would save 3½ tons per week. This has been done.

On the boilers, a long-term scheme was suggested involving major alterations and the installation of new forced draught fans and a new economiser. It was shown that while the firm had thought in the past that the boiler itself was in poor condition, the true state of affairs was that the low quantity of steam available was due to the porced and I.D. fans being of insufficient capacity, although the boiler was actually quite capable of generating more steam if only the draught were available. Contract has been placed and work is proceeding. Now complete.

To sum up, the firm burnt 430 tons per week at the time of our visit, and have already reduced this consumption by 110 tons per week, plus 20 per cent. increased production in addition, against a predicted 116 tons per week on level of production as at time of survey.

Fulton's Ltd., Paisley

At a second firm, an associated company of the first, engaged in the same trade of cloth dyeing and finishing, a similar survey was carried out in twelve days. It was shown that by similar enclosing of dyevats, 40 tons per week of fuel could be saved; by improving the driers, re-organization of the air heater batteries supplying the driers andcutting out idle time running, a saving of 48 tons per week could be made. By improvements on the process plant an additional saving of 25 tons per week was shown possible. This included a rather interesting scheme which we suggested which involved the use of the exhaust steam from a battery of cloth finishing presses to preheat water for dyeing purposes. It was shown that a total saving of 114 tons per week was possible on the process side of the works. On the boiler plant it was shown that re-arrangement of the flue gas passages, in order to utilize an old condemned economiser to preheat water, would save 20 tons per week.

At this firm a total saving of 134 tons per week or 36 per cent. of the present consumption of 367 tons per week was shown possible, representing a financial saving of £400 per week or £20,000 per year. At the present moment the firm state that about half the alterations have been completed and fuel saving is 50 tons per week at present.

To sum up, the Ministry's Advisory Services, by increasing the efficiency of fuel usage, are making a considerable contribution towards the reduction of smoke nuisance. Smoke and fumes are largely the result of waste in fuel usage and are literally allowing some of the heat in the coal to pass up the chimney. While a perfectly clear chimney does not necessarily indicate an efficient plant, it is true to say that a chimney emitting black smoke definitely shows there is a fuel-wasting plant in operation. The Ministry's aim is for a thin haze to be seen from chimneys, which is not only a sign of efficient combustion but will also be welcomed by your society as another plant that will not cause a nuisance from smoke.

Conference on Ash and Clinker

An important special study of the subject of ash and clinker in industry is being organized by the Institute of Fuel and will be of interest to many members of the Society. Meetings will be held in London on October 28th and 29th, when a series of eleven papers will be read. They will include consideration of the occurrence and fundamental properties of ash, methods of sampling and analysis and the partial removal of ash from coal by cleaning processes. Problems of more practical interest will include the treatment and disposal of ash and clinker, the problems of deposits and corrosion, the quantitative effect of ash upon boiler efficiency, and the question of ash and air pollution.

Programmes and conference membership forms may be obtained from the Secretary of the Institute, 18 Devonshire Street, London, W.1. on application. A conference fee of £1 11s. 6d. (one guinea for Institute members) covers the receipt of preprints of papers and a copy of the final report of the proceedings.

SMOKE PREVENTION ABSTRACTS

191. Climate and the Distribution of Disease. Passmore, R., and Sutherland, G. W. (Practitioner, June, 1952 **168**, 555-562). Climate itself can directly produce disease (e.g., frostbite) but only in special circumstances. Much more important are indirect climatic effects operating through food supply, general sanitary and social environment, including air pollution, and upon micro-organisms and their insect and other vectors. The geographical distribution of disease cannot be described in terms of climate alone. Each climatic region is essentially transitional in character and it is impossible to de-limit such regions with hard boundary lines. Likewise, the boundaries of disease distribution cannot be sharply drawn. Climatologists have a contribution to make to the understanding of disease distributions, but this can only be effective if they work in close association with medical practitioners, epidemiologists, bacteriologists and physiologists who understand the special problems which must be solved. At present, routine meteorological records are collected primarily for farmers and travellers. Climatologists may have to evolve new methods for the solving of medical problems.

192. Separation of Airborne Dust and Particles, Davies, C. N. (Paper to Inst. Mech. Engs., July, 1952). The paper, which is based on one read at the conference on Industrial Hygiene, Yugoslav Academy of Sciences and Arts, Zagreb, 1950, is a study of the physical theory underlying various methods of separating particles from gases. Emphasis is entirely on fundamental considerations which lead to formulae of value to those concerned with the design and engineering of separators. New theories of the conical elutriator, the cyclone, and of fibrous filtration are put forward, together with graphs and tables which enable them to be applied without difficulty to practical problems.

193. Air Pollution in Los Angeles County, Magill, P. L. and Benoliel, R. W. (Indust. and Eng. Chem U.S.A., June, 1952, **44,** 1347-1351). The paper considers the contribution of combustion products to the area smog. 50,000 tons of fuel and rubbish are burned in the county each day. Industrial and public burning of these materials contributes daily 1,800 tons of impurities, and household burning of rubbish, 4,000 tons a day, send 550 tons of organic materials into the air every 24 hours. Approximately two-thirds of the chemicals entering the air from combustion are organic in nature. Exhaust fumes from approximately 2 million automobiles, buses, and trucks in the county contribute daily another 350 tons of organic substances as well as 30 tons of aldehydes and 40 tons of nitrogen oxides.

194. Chemistry and Physiology of Los Angeles Smog, Haagen-Smit, A. J. (Ind. and Eng. Chem., U.S.A., June, 1952, **44,** 1342-1346). Air pollution in the Los Angeles area is characterized by a decrease in visibility, crop damage, eye irritation, objectionable odour and rubber deterioration. These effects are attributed to the release of large quantities of hydrocarbons and nitrogen oxides to the atmosphere. The photochemical action of nitrogen oxides oxidizes the hydrocarbons and thereby forms ozone, responsible for rubber cracking. Under experimental conditions, organic peroxides formed in the vapour phase oxidation of hydrocarbons have been shown to give eye irritation and crop damage closely resembling that observed on smog days. Odours observed in oxidation of gasoline fractions are similar to those associated with smog. Hydrocarbons present in cracked petroleum products, harmless in themselves, are transformed in the atmosphere into compounds highly irritating to both plants and animals, and should therefore be considered as potentially toxic materials.

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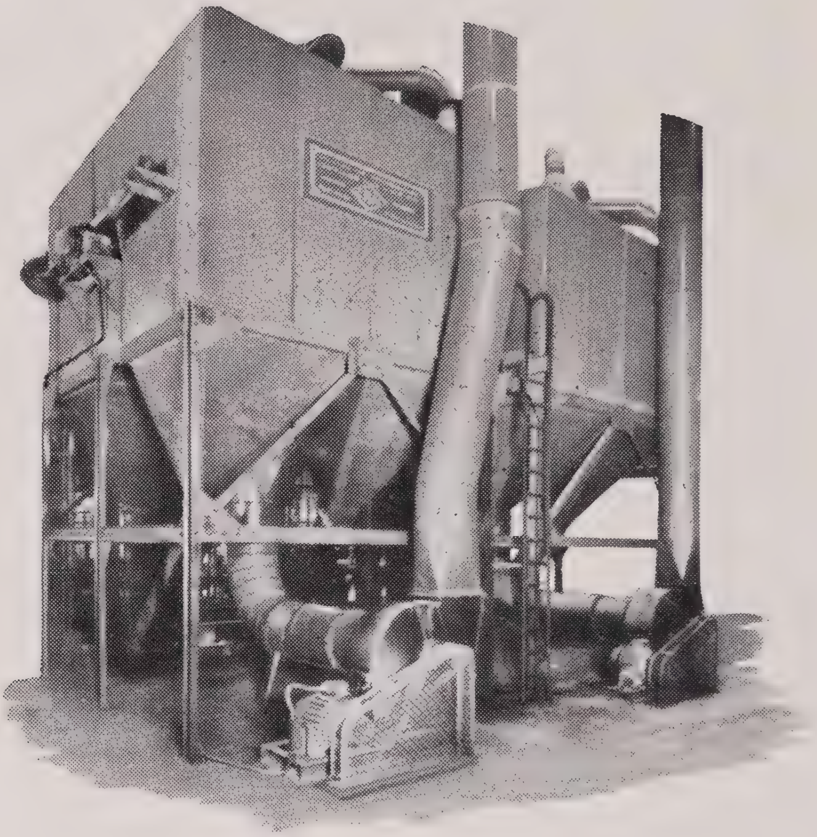

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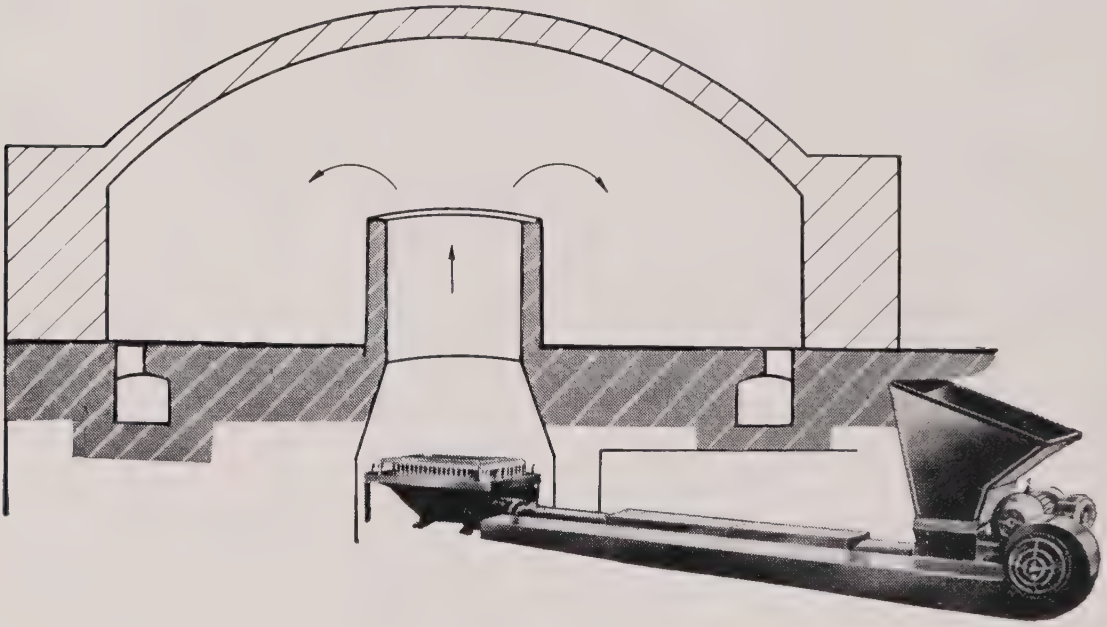

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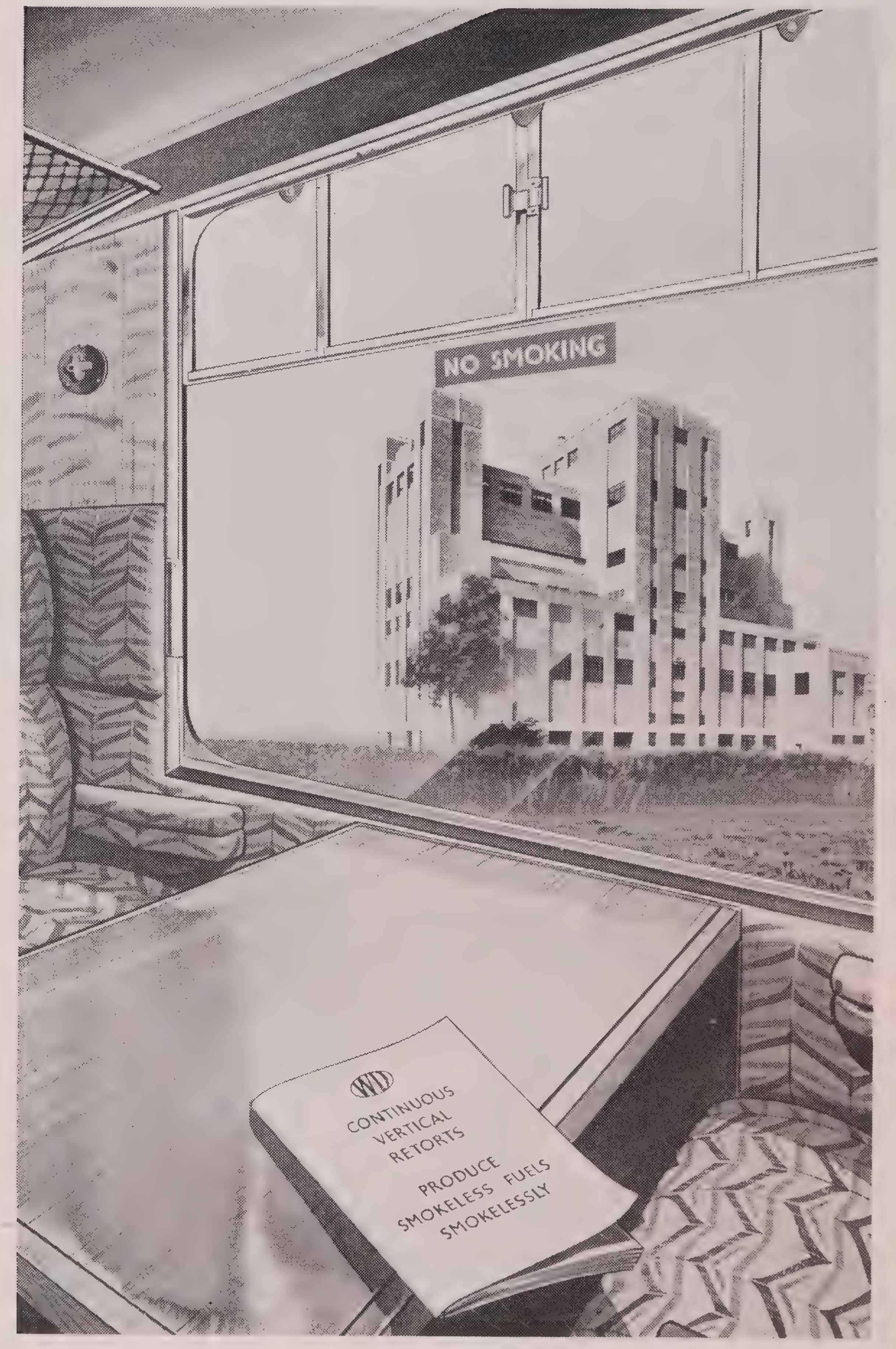

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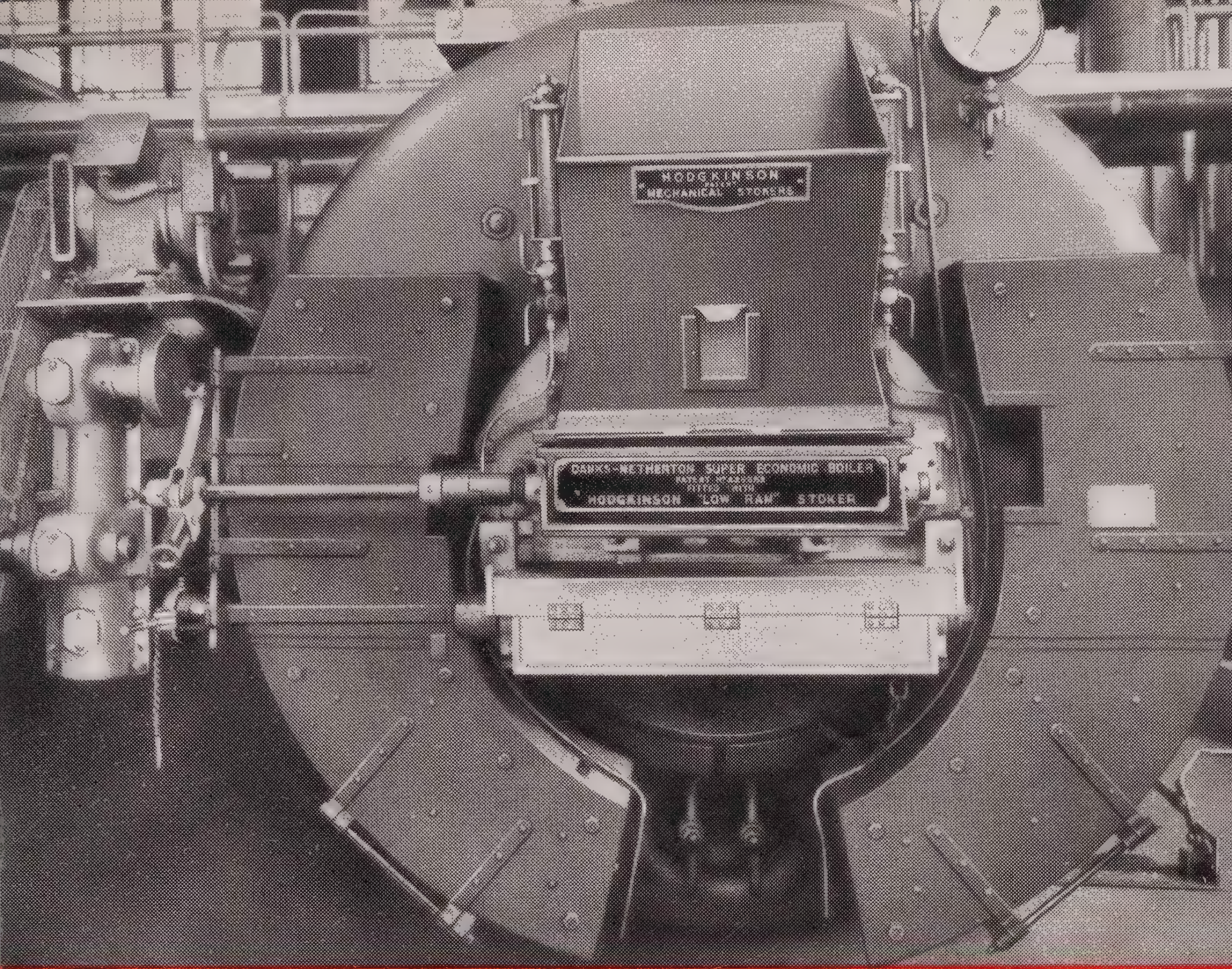
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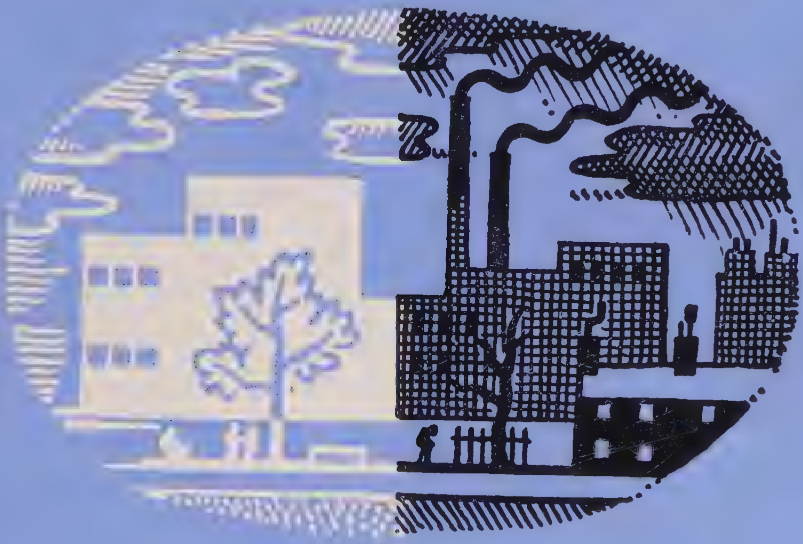

No. 84 WINTER 1952

ONE SHILLING

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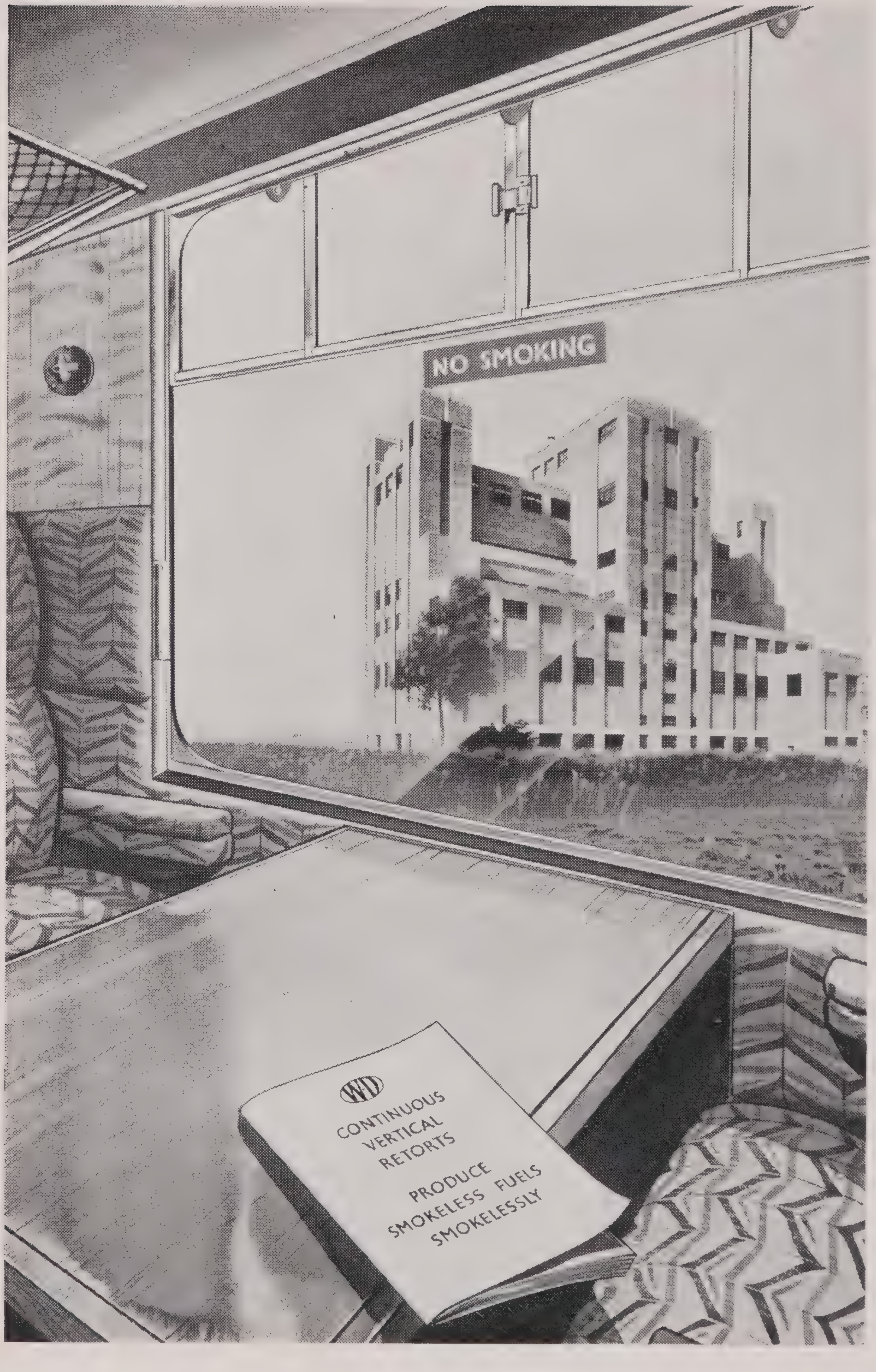
Impressions of the Portsmouth Conference
Meetham's " Atmospheric Pollution "
The Fuel, Power—and Ridley—Debate
etc., etc.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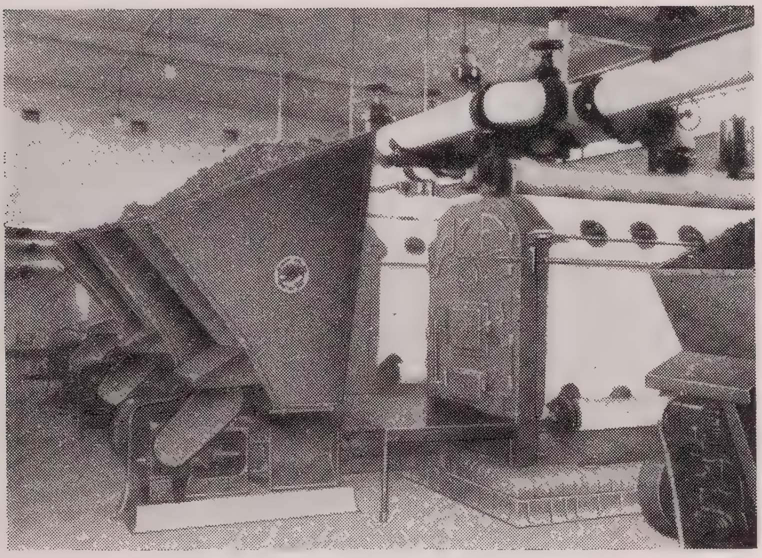

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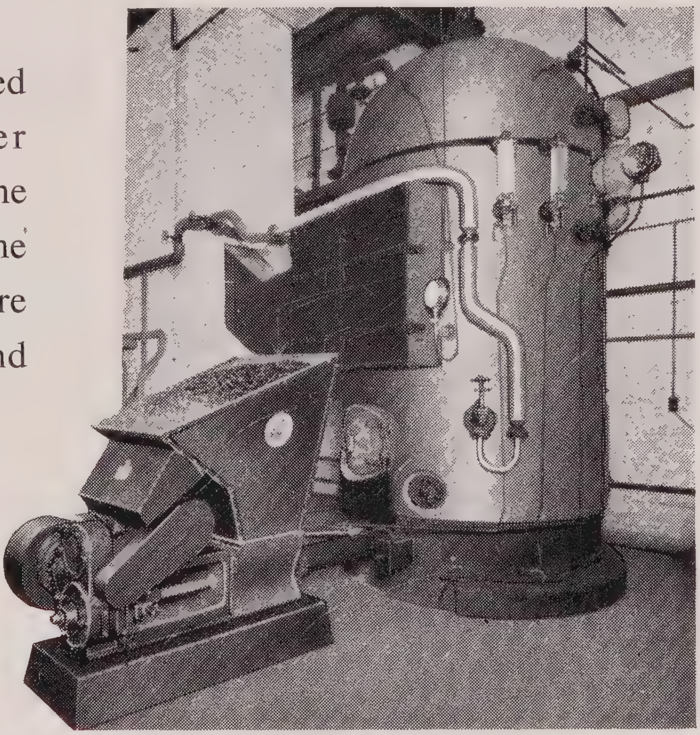

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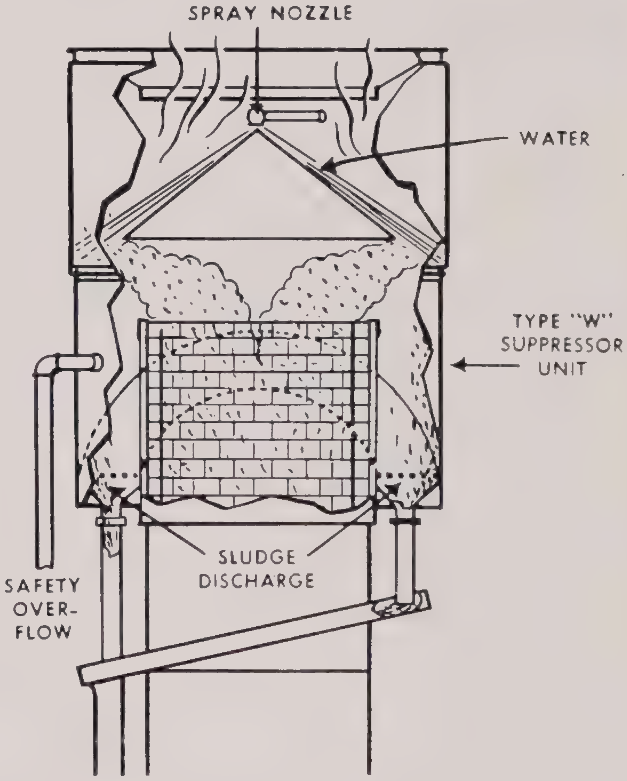

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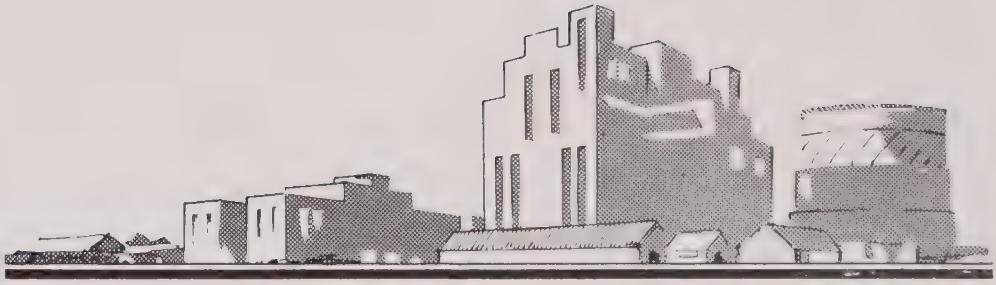

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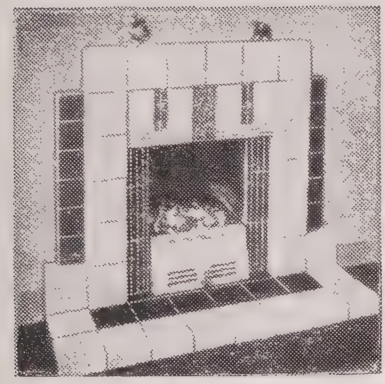

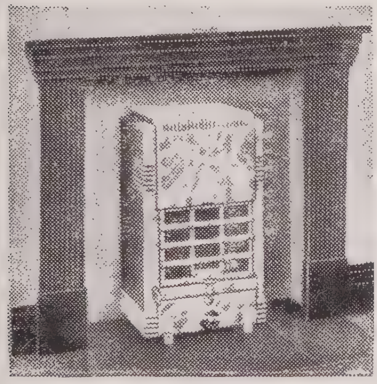

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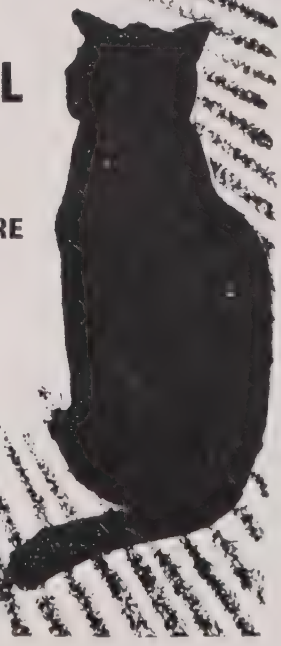

SMOKELESS AIR

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SMOKELESS AIR is published quarterly by the National Smoke Abatement Society at Chandos House, Buckingham Gate, Westminster, S.W.I. Tel. : ABBey 1359 (Editorial and Advertising). Issued gratis to Members and Representatives of Members. Subscription rate for SMOKELESS AIR only, 4s. per annum, post-free.

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Among his diverse accomplishments were the study of chemistry, the writing of books on many subjects, whilst his advice was sought in planning gardens and compiling libraries.

A Royalist, he became the confidante of King Charles II to whom, in 1661, he presented his well known ''Fumifugium: or the inconvenience of the aer and smoak of London dissipated together with some remedies'', one of which was the planting of sweet smelling trees in London to purify the air.

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Taking in the Slack

In the extracts from the recent Fuel and Power Debate in the House of Commons, recorded on another page, the statement of the Minister about the use of " rough small coal " (or " slack ") in modern open grates is given verbatim. The statement has tended to be misinterpreted, and requires careful reading. The Minister did not say that the modern open grates had been designed for rough small coal, but for graded small coal. Such fuel, he suggested, burned rather too rapidly, but this could be put right if it were mixed with small—presumably slack—coal.

There are three aspects of the statement that we find disturbing and one on which comment must be made. First, the new grates, now being installed in such large numbers, were of course designed in the first place as *smokeless fuel* grates, and their original, and still most important function, is to burn gas coke that is frequently unsuitable in older types of open fire. And although Coalite and Rexco will burn in any grate, they will burn even more efficiently in the new types. They are in fact still primarily smokeless fuel grates, for the higher efficiencies of which they are capable are attained only if smokeless fuel is used. They can, and for the present many of them must, burn raw coal, but their efficiency is then considerably less.

Secondly, one of the features of these grates that distinguishes them from older types is the wider spacing of their firebars, and this, one would imagine, would make them particularly unsuitable for slacks, much of which will fall into the ashpan. Lastly, and from our point of view of most importance, the burning—or perhaps more correctly the carbonizing—of slacks in open fires, especially when " banked " or " damped down," is one of the most effective and unfailing ways imaginable of producing smoke—thick, tarry, low-temperature smoke, with its full quota of benzpyrene. There may be some temporary case for allowing householders to burn fuel that should be used only for industrial purposes, but actually to encourage them to do so, and on smokeless fuel grates, is indeed most regrettable from the viewpoint of public health. (Since this was written the rough slack has been dubbed " nutty " slack. The Society's Technical Committee has set up a subcommittee to consider and report on the questions raised by its use.)

Save with Coke

Much more cheerful news from the Minister was his announcement that the domestic allocation of coke was to be increased by 10 cwt. for the winter months. The fact that coke is in such good supply, together with the news that 1,700,000 of the new grates are being installed this year, makes it still more difficult to appreciate the reasons for the rejection of Salford's smokeless zones scheme.

We are glad that the Ridley Committee has recommended the production of more solid smokeless fuels, such as Coalite, Rexco and Phurnacite, although they do not think that big increases in the supply of coke are likely in the near future. But one wonders what public demand may achieve as the smokeless fuels become better known and appreciated. At a recent joint meeting of the North West Division of the Society and the Institute of Fuel in Manchester, Dr. Weston of the Building Research Department told of an experiment carried out in a group of the experimental houses at Abbots Langley. In one half of the houses for one half of the winter period the occupants used only coke; in the other half, only coal. For the second half of the period each group of houses went on to the other fuel. By this means any individual differences in usage were cancelled out. It was found, over the whole period, that *the weight of coke consumed was* 35 *per cent. less than the weight of coal.* Further, after the trial, a majority of the householders stated that they preferred coke to coal.

Plenty to Read

This issue, from the number of reviews it contains, might be called our Winter Book Number. We have already referred to the Ridley Report, which is one of the publications discussed, and in addition there are reviews of Dr. Meetham's new book, the imposing U.S. Technical Conference Report, the report on Fuel Research, 1951, the B.E.A. annual report, and others, all of which have some special interest to the readers of this journal. The literature that supports the case for smokeless air grows continually, and in one way or another it is all creating and educating public opinion. It is, however, becoming more and more difficult even for those who are most keenly interested in the subject to keep *au fait* with everything that is written, a situation which enhances the value of this journal as a review and source of reference. Incidentally, we would like to remind readers that the Society is recognized by the Publishers' Association as a Bookseller for all publications relating to air pollution and allied subjects, and that all books we review may be ordered from our offices. This is, of course, of benefit to the Society, and is a service we hope more members will use.

Writing to the Papers

A few people like to write to the newspapers. Others would never dream of it—but if they are members of the Society we would like them to do so, on behalf of smoke abatement. We are prompted to make this request—not for the first time—by learning that a recent lively and very useful correspondence in the *Manchester Guardian* was started off by a letter (published over his initials) from one of our members. Whatever the outcome of any correspondence may be, the very publication of letters about smoke and smoke prevention is important to the steady building up of public opinion that is one of the Society's main purposes. Letters to local or regional papers have a very good chance of being published, especially if they are brief and relate to something specific that concerns the area covered by the paper. It is a job that can be done by everyone, in his or her own individual way, and if all our members were to make a habit of it a great deal of progress could be made.

New Vice-Presidents

Two new Vice-Presidents were declared elected at the Annual General Meeting held during the Portsmouth Conference. They are Alderman Miss Alice Arnold and Commander Colin Buist, R.N. (ret.).

Alderman Miss Arnold is a representative of the City Council of Coventry. She has been a member of the Council for 32 years, and is a former Mayor. She is at present " mother " of the Council, having had longer service than any other member. She has done much to further the cause of smoke abatement in Coventry and the Midlands, and played a prominent part in obtaining the Council's agreement to seek powers for smokeless zones and prior approval. Her election is a way of honouring her personally for her services to smoke abatement, and additionally, of paying through her a tribute to the city she represents for making history by the establishment of the first smokeless zone in the country.

Commander Buist is well known in the fuel world as the Chairman, since 1949, when he succeeded the late Colonel Bristow, of the pioneer smokeless fuel firm of Coalite and Chemical Products Ltd. He is also Chairman of the Low Temperature Coal Distillers' Association of Great Britain. He was educated at the Royal Naval Colleges at Osborne and Dartmouth, and served at sea in the Royal Navy throughout the first world war. Later he retired, but was recalled for duty with the Royal Navy during the recent war. He was Extra Equerry to H.M. King George VI. from 1937 to 1952, and has now been honoured by appointment as Extra Equerry to H.M. Queen Elizabeth II.

NOTICE TO MEMBERS

Annual Subscription Amendments

The following resolution was adopted at the Annual General Meeting of the Society, held at Portsmouth on September 26th, 1952:

That Clauses 5, 6, 7 and 8 of the Constitution of the Society be so amended that the minimum rates of annual subscription for the several classes of membership shall be as follows (the present minimum rates being shown in brackets):

Clause 5(a) Individual Members—
15 shillings (10s. 6d.)

Clause 6(c) Local Authority Members with a population of

Less than 25,000	3 guineas	(2)
25,000 to 50,000	4 ,,	(3)
50,000 to 75,000	5 ,,	(4)
75,000 to 100,000	7 ,,	(5)
100,000 to 250,000	12 ,,	(10)
250,000 to 500,000	18 ,,	(15)
500,000 and over	30 ,,	(25)

Clause 7(c) Institution Members—
12 or 7 guineas (10 or 5 guineas)

Clause 8(c) Corporate Members—
12 or 7 guineas (10 or 5 guineas)

and that in Clause 11(b), relating to additional free copies of publications " three guineas " be substituted for " two guineas."

THE RIDLEY REPORT

Endorsement of Smoke Prevention Policies

Policy for the Use of Fuel and Power Resources. Cmd. 8647. 8vo. pp.242. H. M. Stationery Office, London, 6s. 6d. net.

IT has been said that this Report of the Committee on National Fuel Policy emphasizes the need for a Committee to propound a National Fuel Policy. According to the way one looks at it, there may be a little truth in this, and there has been a certain amount of disappointment that the Committee did not produce the neat, all-embracing policy so anxiously desired by many. Nevertheless, even if the Committee has not erected an imposing edifice it has made a considerable number of excellent bricks. In particular the National Smoke Abatement Society may thank Lord Ridley and his colleagues, and congratulate itself, on the treatment given to smoke abatement.

Before discussing this, to us the most important part of the Report, an account may be given of some of the more general views and recommendations of the Committee. Although no new organization for the central control of the fuel industries is advocated—the existing powers of the Minister of Fuel and Power are noted—it is recommended that there should be a Tariffs Advisory Committee, and, to secure co-operation between the different industries in production and distribution, there should be a Joint Planning Board.

On the domestic side the more important of a number of interesting recommendations are that solid fuel room-heating appliances should be required to give a room efficiency of 40 per cent. (with coal); that appliances should be clearly marked with their test efficiences; that a 100 per cent. purchase tax should be put on appliances that do not reach these standards; that high efficiency " utility " appliances capable of easy installation in existing fire openings, with convection heating and a restricted throat, should be encouraged; and that simple devices should be encouraged for inserting in existing flues to restrict the chimney throat. The insulation of houses should be encouraged and publicized, and financial incentives should be provided for the installation of improved appliances and insulation of houses.

Although the Committee agrees that greater efficiency is obtainable with coke in suitably designed fires, and that a greater use of this and other smokeless fuels is desirable, it sees no likelihood of a great expansion in the supply of these fuels in the next few years. The supply of coke, however, might be supplemented by an increased production of semi-coke from low temperature carbonization works.

Industrial Efficiency

The Society has always stressed the need for greater fuel efficiency in industry—and was indeed the first body to do so—and the Committee's recommendations in this field are close to our own desires. There should be, they say, a great increase in the service of providing industry with advice on fuel efficiency. The services of the Ministry of Fuel and Power's organization for this purpose are rightly commended, but in addition it is suggested that industry should set up its own advisory service. Loans for approved fuel saving installations should be amplified, on more attractive terms, and stokers should be encouraged to raise their efficiency by arrangements for improving their status. As proposed by the Society a number of years ago, and reiterated in a resolution passed at Portsmouth, "ultimately proof of proficiency should be a condition of employment in stoking."

We like, and draw attention to, the recommendation that "Government Departments and other public authorities should take the lead in promoting fuel efficiency."

Considering the railways, the Committee urges the acceleration of trials of new forms of traction, and thinks the Railway Executive should "in their immediate and longer term investment planning allow greater weight to the need to make a substantial improvement in fuel efficiency."

The report ends on page 72 of the volume; the next 165 pages being devoted to various appendices, a great deal of the contents of which are arguments and counter-arguments from the national fuel and power organizations, although there is also much valuable technical information of a less controversial character. Most important of all, to readers of this journal, will be Appendix IV, on Smoke Abatement. Here the Committee, for convenience, have brought together various references and views, and as a result have produced a most valuable summary of the case for, and the means for achieving progress in, smoke abatement. The only way of adequately reviewing this statement is to reproduce it in full, and accordingly it follows below as an appendix to this review.

This Appendix IV has already created much attention. In the Fuel and Power debate in the House of Commons on 28th October, Mr. H. E. Holmes suggested that the Society should reprint the second paragraph in red and circularize it widely throughout the land. *Municipal Journal*, discussing the Report, concluded that "It will be seen that the Committee has studied closely the evidence submitted by the National Smoke Abatement Society." (This evidence was published in SMOKELESS AIR, Spring, 1952, page 110).

We could, naturally, add further points to the Appendix, and there are a few statements we might argue about—such as that on the question of byelaws in paragraph 6 (1). It would however be churlish to criticize details in a statement that is of such importance to the smoke prevention movement, not only for what it says, but for the weight and *cachet* it derives from being published between the blue covers of a Government report.

Two comments may be added: (1) this is the first endorsement of an official report of the principle of Prior Approval for industrial installations; (2) we trust that the Ministry of Housing and Local Government will take careful note of the very last sentence of the Appendix.

RIDLEY REPORT—APPENDIX IV

Smoke Abatement

1. Chapter 1, paragraph 4 states that "the best use of fuel and power is determined by the value of the resources consumed to provide the supply, the social costs to the community of producing or using it, and the value to the individual consumer of the specific fuel and power service."

2. One heavy social cost to the community is the smoke pollution usually produced when raw coal is burnt inefficiently. It is impossible to measure all this cost in money. Estimates have been cited from time to time for parts of it (for instance, in the Egerton Report (Appendix A 4, 5)). In real terms it is certainly enormous as every-day observation in our large towns and cities shows—most clearly to those who know conditions abroad, where less coal is burnt raw in inefficient conditions. Among the social costs are the loss of sunlight and the harm to the health of the citizens, the reduction in the amenities of town life, the damage to buildings and textile fabrics, the extra costs of painting,

washing and laundry, and the loss of food production which results from the smoke deposit in the countryside around the towns. These are only some of the main losses which the community endures through smoke.

3. But apart from the loss which the community suffers from smoke pollution, there is the inefficiency of which smoke is the visible symptom.

4. The main sources of smoke pollution in the United Kingdom are:

(1) The millions of households which use raw coal burnt in old-fashioned open grates as the main source of heat comfort. There are perhaps 12 million such open fires in regular use, together burning more than 30 million tons of coal a year—and producing a million tons of smoke. Thus the townsman pays heavily for smoke, both directly as a coal consumer, and indirectly as a citizen living in dirty air.

(2) Smaller industrial boilers and furnaces burning raw coal.

(3) Steam railway locomotives.

5. In the Report proposals have been made for increasing the efficiency of fuel use in each of these three main smoke-producing uses:

(1) Domestic use. The Committee have recommended in Chapter V:

- (*a*) The development of more efficient types of open fire which will burn coal with less smoke and greater efficiency even than the standard improved fires now coming into popular use.
- (*b*) The use of more gas domestically during peak hours on the electricity supply system, with correspondingly greater supplies of coke.

(2) Industrial boilers and furnaces. The Committee have recommended in Chapter VI:

- (*a*) The expansion of the fuel efficiency advisory service.
- (*b*) Financial incentives to firms for installing fuel efficiency equipment.
- (*c*) The requirement of prior approval by the Government for the heating installations in new industrial and commercial buildings.
- (*d*) More schemes for the training of stokers in the efficient and smokeless firing of boilers and furnaces.

Eliminating smoke does not necessarily mean attaining fuel efficiency; in some conditions, smoke can be avoided by reducing boiler efficiency, for instance by admitting additional air. Happily, however, the efficient use of fuel does mean its smokeless use.

(3) Steam railway locomotives. There appear to be no practicable methods of making the standard steam railway locomotive fuel efficient and smokeless; progress here must come through the switch to other methods of traction which the Committee have recommended in Chapter VI on the score of fuel efficiency, but it cannot be done quickly because of the huge investment required.

6. All the above methods are means to increase fuel efficiency and incidentally to reduce smoke pollution. The Committee have considered also measures primarily for reducing smoke pollution. They are:

(1) The wider use of the low temperature carbonisation process. This method produces solid smokeless fuel more acceptable to most householders and more easily burnable than gasworks coke in most existing grates; on these grounds the Committee have recommended in Chapter V that its extension should be encouraged.

(2) The more general adoption of smoke abatement bye-laws by local authorities. Under the Public Health Act, 1936, local authorities may enact bye-laws intended to check smoke pollution from most sources other

than the domestic chimney; about one in five of the urban authorities have done so. It is doubtful whether the more general adoption of the bye-laws would, in present conditions, make any great contribution to reducing smoke pollution in our towns. What is important is that consumers should be able to get the sorts of fuels which can be burnt efficiently in the equipment they have, and, even more important, that fuel advisory service should be readily available to them. When these conditions obtain, there may be a case for the more general adoption of bye-laws, possibly with some stiffening of the penalties and widening of their scope. Until then, however, there is danger that more general and stiffer legislation against smoke might actually reduce fuel efficiency, as firms sought to avoid prosecution by using excess air in their appliances.

(3) The establishment of more smokeless zones. The Simon Report recommended that legislation should be passed to enable urban authorities to define parts of their areas where smoke emission would be prohibited. Since 1946 fifteen local authorities have been granted powers in private legislation to declare smokeless zones, and two smokeless zones—at Coventry and Manchester—are already in existence. Further progress in the establishment of smokeless zones depends on having enough smokeless fuel and suitable appliances. As they become available, there is, in the Committee's view, a good case for more widespread declaration of smokeless zones, in the cause both of reducing the social costs of smoke pollution and improving fuel efficiency.

B.C.U.R.A.'s. Work on Smoke

Sir Charles Ellis, F.R.S., in his Presidential Address at the 1952 annual general meeting of the British Coal Utilization Research Association, made some interesting references to smoke prevention.

" The problems of smoke formation and of grit emission," he said, " have continued to exercise our active attention. As problems of atmospheric pollution they are related but in most other ways are quite unrelated. The problems of smoke are being tackled along four different lines. The laboratory studies are designed to find what factors affect the release of smoke when coal burns, whether any chemical pre-treatment of coal can reduce smoke formation, under what conditions released tar vapours can be destroyed and finally what design factors in domestic appliances will lead to reduced emission. The studies are at an early stage, but one or two interesting facts have emerged. We find, for instance, that when a hydrocarbon burns in an atmosphere of air it produces more soot than when the flame is " reversed " so that the air, as it were, " burns " in an atmosphere of gas: moreover the soot formed differs in the two cases. No explanation of this is yet available. Another result is that we have confirmed by a series of tests that a hard coal when burning produces less smoke than a bright coal of same rank.

" More empirical approaches to the smoke problem in domestic appliances have shown that in certain ways we can considerably reduce smoke emission from an appliance of the open type and attain substantial smokelessness at the flue exit of a closed stove. With the open appliance conditions require rigid control such as is at present only possible under research conditions: with regard to the closed stove, a prototype apparatus has been made and is the subject of a patent application."

A Portsmouth Conference Paper

AIR POLLUTION AND CANCER OF THE LUNG

by

Percy Stocks, C.M.G., M.D.

Senior Research Fellow, British Empire Cancer Campaign, and Medical Statistician, World Health Organization

In evidence relating to probable effects of the location of industry on death rates in the past, given by the General Register Office to the Royal Commission on the Geographical Distribution of the Industrial Population some fifteen years ago, I mentioned the higher mortality from respiratory diseases which had always characterized towns on the western side of the Pennine Chain compared with those on the Yorkshire side. Mills and factories had usually been built in the bottoms of the valleys, convenient for rail, road and canal transport, and the dwelling houses had tended to spread up the hill slopes, with the result, I suggested, that since the prevailing winds were westerly, the east Lancashire towns were generally more pickled in their own smoke than the Yorkshire towns. This applied also to parts of the Potteries; but as an example of an industrial city which seemed to me to escape the worst of its smoke and rather to inflict it on the countryside to the east, dimming the sun over long distances, I instanced Sheffield whose death rates from respiratory disease were low.

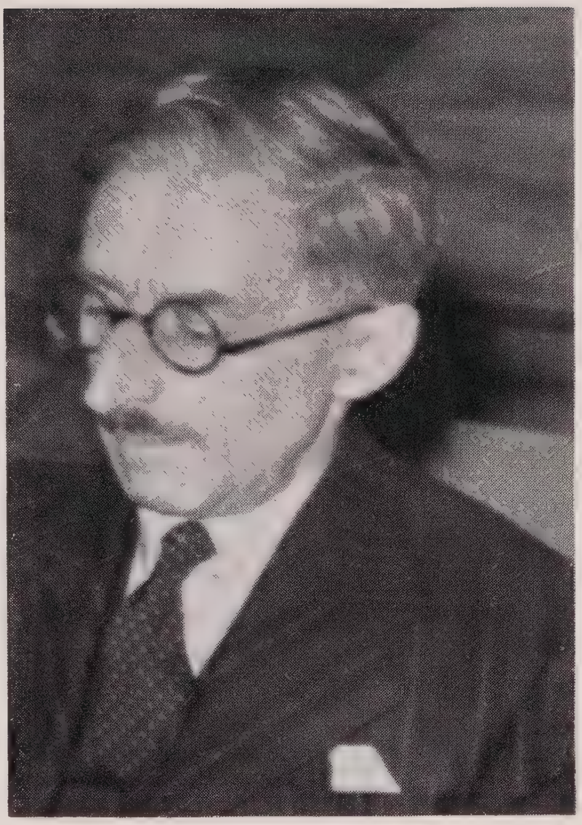
At that time, when we thought of fatal respiratory disease, it was in terms of pneumonia, bronchitis and tuberculosis of the lungs, which together were causing about 80,000 deaths a year in England and Wales in 1935. The death rates from those causes had for long been falling slowly, but another disease was coming into the picture, without attracting much attention, namely cancer of the lung and bronchus, which doctors recognized as the cause of about 3,400 deaths in 1935. During the next 15 years the position changed very greatly, for thanks partly to the discovery of the sulphonamide drugs and penicillin, the total deaths from pneumonia, bronchitis and pulmonary tuberculosis fell to about 60,000, whereas those attributed to lung cancer increased to 12,000. When drawing conclusions from such startling changes it has to be remembered that many deaths from lung cancer were not recognized as such in the past, being attributed to pneumonia or chronic bronchitis, or occasionally to phthisis. Infection often caused lung cancer patients to die of pneumonia in an early stage of the disease before its true nature could be recognized, whereas now such early death may be prevented by the new drugs, and the cancer then progresses and is diagnosed as such by the time it proves fatal. However that may be, it would be dangerous to assume that the steady and rapid increase in lung cancer mortality, as indicated by death certificates, can be explained away so conveniently, for the year by year increase shows no sign of lessening. We have to anticipate now that out of any assembly of 400 men aged about 55, at least ten will die of lung cancer within the next 20 years, even if the rate remains at its present level.

Carcinogenic Substances

Although we do not yet know the true nature of cancer, quite a number of chemical substances have been proved to be carcinogenic, that is to say capable of producing cancer when continually or frequently in contact with certain parts of the body. People exposed to such substances repeatedly in the course of their occupations often developed cancer, and by suitable precautionary measures chimney sweeps, mulespinners in cotton mills and chrome workers have for long been protected from skin cancer. Similarly, handlers of certain luminous paints need to be protected against cancer of the bones, and chemical workers in certain processes of dye manufacture against cancer of the bladder. It was reasonable to suppose, therefore, that lung cancer could be induced by inhalation of some carcinogenic substance, which might come from coal gas, road dust, petrol fumes, smoke from domestic chimneys, industrial smoke, tobacco smoke, or some other source of air pollution. It has been found, for example, that lung cancer is very prevalent amongst certain workers in the chromate industry, and in a particular mine where the dust was very radio-active; and statistics also indicate some excess of mortality in some occupations connected with coal gas production. With these facts and possibilities in mind, the Medical Research Council called a conference in 1946 to consider what investigations could be carried out, and a working party initiated several studies which have already proved fruitful.

In the first place, a series of 709 patients found to have lung cancer in a number of London hospitals were questioned as to their history of tobacco smoking, and compared with a series of patients found to have cancer in other organs such as the stomach, or no cancer at all. The results, published in a paper by Doll and Bradford Hill in 1950,[1] showed a remarkable preponderance of heavy tobacco smokers amongst the lung cancer patients. Cigarette smokers were more liable to develop the disease than pipe smokers, and the risk appeared to increase in proportion with the number of cigarettes smoked. Only two men who had always been non-smokers were found amongst 649 cases, compared with 27 amongst the same number of men in the control group who did not have lung cancer. Inhaling did not appear to add to the risk. A similar study by Wynder and Graham in America,[2] of 605 men with lung cancer, produced almost the same result, except that the risk seemed to be increased by the habit of inhaling. These researches have proved, in my opinion, that tobacco smoking is an important factor in the genesis of lung cancer; but they have not proved that it is the only important factor, and statistical evidence can now be advanced in favour of the view that atmospheric pollution by some carcinogenic substance present in smoke from domestic chimneys may be an additional factor.

In a report on the Regional Distribution of Cancer Death-rates in England and Wales, issued from the General Register Office in 1947, I showed that London and certain large cities, notably Manchester, Liverpool and Nottingham, had peculiarly high rates for lung cancer during the decade 1921-30; and that there was in general a steep downward gradient of rates from London, through large and small towns to rural districts. Furthermore, amongst the county boroughs there was a curious correspondence in the reverse sense between their lung cancer death rates and annual averages of the amounts of recorded sunshine. I concluded that either smokiness of the atmosphere is an important factor in itself in producing cancer of the lungs, or sunshine is an important factor in preventing its incidence.



Dr. Percy Stocks

Photographed at the Conference

Atmospheric dust is known to contain at least three substances believed to be carcinogenic, namely arsenic, benzpyrene and radio-active particles. Of these arsenic is also present in tobacco; and it has been found recently that the arsenic content of urban air is twice as great in winter as in summer, suggesting that domestic consumption of coal is the chief source since industrial smoke does not vary greatly with season.[3] However, it has been estimated that the amount of arsenic inhaled in a year by ordinary breathing would only be of the order of half a milligram, or the content of about 100 cigarettes. Waller[4] has just shown that the benzpyrene content of the air of eight towns had an even more pronounced winter excess than arsenic, and that it increased with size of town, these facts making it probable that domestic smoke is the principal source of the benzpyrene in the air.

Death Rates in Towns

Such findings seem to link up with the results of a further statistical research on death rates in English towns which I completed a few months ago and which has been published in the *British Journal of Cancer*.[5] First of all I worked out standardized mortality figures for cancer of the lung and bronchus amongst males in each County Borough and each Metropolitan Borough during the recent period 1946-49. The County Boroughs and London were then arranged in groups according to the number of inhabited dwellings at the last census, and when two or more of the towns were actually contiguous (as for example Liverpool, Bootle, Birkenhead and Wallasey) they were treated as a single unit. There were five groups of adjacent towns having more than 200,000 occupied dwellings, and of these the London, Manchester and Merseyside groups gave lung cancer indices around 160, whilst the Birmingham and Leeds groups registered 134 and 132. It is interesting to note that in the first three groups the population densities per acre were 25 or more, whereas in the Birmingham group it was 20 and in the Leeds group only 11. A high population density per acre implies also a high density of domestic chimneys per acre, and, assuming the proportion using coal fires to be constant, pollution of the atmosphere by domestic smoke must depend on at least three factors, the total number of dwellings, their concentration together and the effects of wind. I will refer to wind presently; what I wish to point out here is that, apart from the size of town, there is a positive correlation between density per acre and lung cancer mortality.

Let us now look at the other towns, in descending order of the number of occupied dwellings. Sheffield comes next with 124 thousand dwellings, and its mortality figure was 135, similar to Birmingham and Leeds. Then come Newcastle with Gateshead, with 87 thousand dwellings and a mortality figure 114; and a group of 6 towns each having between 50 thousand and 85 thousand dwellings, giving an aggregate mortality figure 113. After that come 3 towns each with 40 thousand to 50 thousand dwellings, mortality 107; 12 towns each with 30 thousand to 40 thousand dwellings, mortality 104; 13 towns, each with 20 thousand to 30 thousand dwellings, mortality 100. Finally there are 29 towns having less than 20 thousand dwellings, which gave an aggregate mortality figure of 89. The lung cancer mortality index for men decreased with remarkable regularity, therefore, according to number of occupied dwellings, from about 160 in the largest and most crowded urban groups to 89 in the smallest. Within the groups having less than 50 thousand dwellings there was a large variation for individual towns, which could be explained by the small numbers of deaths in any one town and by special peculiarities. The seaside resorts Brighton, Southend, Eastbourne and Southport have rather high rates, but they are dormitory towns and places to which many men retire after working a lifetime in London, Manchester and Liverpool, so they seem to be exceptions which prove the rule. Cardiff and Swansea also have higher rates than their sizes seem to warrant, as have also St. Helens and Warrington.

I have repeated this analysis for deaths of females using a long period of 19 years from 1921 to 1939 in order to get large enough numbers, because the ratio of male to female mortality at ages between 45 and 65 is about 7 to 1 in the towns and 4½ to 1 in rural districts. The result is much the same, except that no sign of any increase with size of town occurs until 40,000 dwellings are reached, the mortality index I used remaining around 75 in towns up to that size. The index then rises quickly to levels of 120 to 140 in urban areas with over 100 thousand dwellings.

The Population Density

When the population densities of large cities are examined in detail, it is found that the density per acre in successive zones around the business centre falls off according to a mathematical law as the distance from the centre increases. If domestic smoke is an important factor in producing a disease, then if there was no wind at all the highest incidence of that disease would be expected about the centre of the town, diminishing in all directions outwards. If there was wind coming from every direction equally over the year, a more diffused, but still symmetrical, distribution of incidence of the disease would be expected. Actually wind does not blow from all quarters equally, and I find that when the wind directions at Greenwich in 12-hour periods throughout the year 1950 are analysed, wind was blowing from one quarter of the circle distributed around WSW during half the time, whereas it was coming from the reverse quarter around ENE, and from each of the other quarters, during only one-sixth of the time. The expected effect of this prevailing direction on smoke density would be to shift the maximum some distance from the centre of Greater London towards ENE. It is interesting to find, therefore, that the map of lung cancer mortality in the county of London during 1946-49 shows a large black patch with the highest death rates covering Finsbury, Shoreditch, Bethnal Green, Stepney and Bermondsey, just where it should be. This might be due to peculiarities of social distribution rather than to smoke and movements of the atmosphere, but there is no evidence as yet that lung cancer is more prevalent in one social class than another, taking the country as a whole.

It is safe to say, I think, that the statistical facts we have extracted so far fit in rather well with the hypothesis that atmospheric pollution by domestic smoke is an important factor in the genesis of lung cancer, and that tobacco smoking is superimposed upon it as another important factor. One cancer producing substance might be common to both kinds of smoke in which case the risk of contracting lung cancer would depend on the total dose received from both sources; and from that it would follow that it is more dangerous to smoke 30 cigarettes a day if one lives or works in a large town than if one lives and works in the country. The same would be true if the carcinogens A and B are different but nevertheless are additive in their effects in the sense that whilst the body could safely deal with, say, one milligram of either A or B, its defences might not stand against both together. If A and B act independently, however, the relation between risk of lung cancer and number of cigarettes smoked should be the same for town dwellers as for country dwellers. An investigation has now been started by the British Empire Cancer Campaign in Liverpool Hospital Region and North Wales in the course of which we hope to find out whether that is the case or not, and also to see whether smoking habits are different in town and country and whether any other factors are associated with lung cancer, such as use of anthracite or oilstoves.

Much of what I have put before you is no more than conjectural as yet, but it can be and will be tested by field research. If it proves to be a correct interpretation, then it will provide an additional incentive to the work of your Society. It will do more than that, however, because if the aggravating causes in cancer of the lung can be identified and then abated to some extent, the same might be done for other forms of cancer which are responsible for much suffering. Ten per cent. of prevention would be much better than ten per cent. improvement in the results of treatment. Tuberculosis has been gradually defeated in the last 80 years, not by spectacular destruction of the tubercle bacillus by some wonder drug but by abating one by one those social factors which intensify the doses of infection we are exposed to, and those nutritional factors which lower the defences of the body against the bacillus. Cancer may have to be defeated in the same sort of way; and I think that in the long run the perseverance of your Society will contribute to that, as it has already undoubtedly contributed to the reduction of other diseases.

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[1] Doll, R., and Hill, B. (1950). *Brit. Med. J.*, **2**, 739.

[2] Wynder, E. L., and Graham, E. A. (1950). J. Amer. Med. Ass., **143,** 329.

[3] Goulden, F., Kennaway, E. L., and Urquhart, M. E. (1952). *Brit. J. Cancer*, **6,** 1.

[4] Waller, R. E. (1952). *Ibid.*, **6,** 8.

[5] Stocks, P. (1952). *Ibid.*, **6,** 99.

The Right Use of Coke

This is the title of a lecture, for which excellent notes have been prepared in pamphlet form by the Gas Council (1 Grosvenor Place, S.W.1), and which naturally is in part a smoke abatement lecture. It will be of value to readers who are themselves lecturing, even if domestic fuel questions are only a part of the ground they cover.

Smokeless Briquetted Fuels

Speaking at a meeting of the Women's Advisory Council on Solid Fuel, in London, on 9th October, Dr. Bronowski, Research Director to the National Coal Board, said that they were experimenting to make a whole range of briquetted fuels that would burn steadily for many hours, without smoke, and with intense and uniform heat. Under the Coal Board's plan to raise output to 240 million tons or more by 1962 the seams to be tapped would consist more and more of smoky and rather dusty coal.

CONCERNING COMPLAINTS

Eston U.D.C. have addressed a new protest to Dorman, Long and Company about smoke and fumes from their Cleveland Steel Works at Grangemouth.

Fareham U.D.C. have decided to take legal opinion with a view to restraining the Esso Oil Company from causing objectionable smells, alleged to come from the Fareham Refinery.

Ellesmere Port Health Committee have been considering a report on odours alleged to emanate from the Shell Refineries, complaints on which have been received from adjoining rural areas.

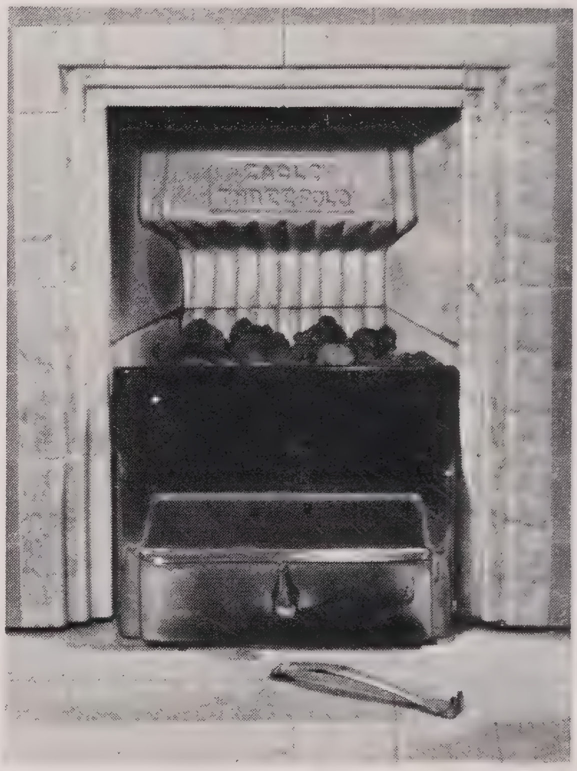
Chesterfield County Magistrates, on September 27th, declined to hear a case when Clugstone (Staveley) Ltd. was summoned by Staveley U.D.C. for failing to abate a nuisance in the town on December 5th, 1951. The nuisance was in respect of dust and fumes. The magistrates agreed that the matter was of such importance that it should be dealt with in the High Court and the company's counsel stated that every slag and iron and steel manufacturer in the district was interested and was represented in the courtroom.

The Ministry of Housing and Local Government have declined to approve a smoke abatement bye-law applied for by the Borough of Dudley.

It is reported that 36 out of 60 industrial chimneys in the Doncaster Rural District area show excessive smoke pollution.

After repeated protests from the Southwark Council the British Electricity Authority have stated they will use the old coal-burning Bankside Power Station only in an emergency. There have been many complaints about grit emission in the vicinity of the station, and deposits of up to 200 tons per month per square mile have been recorded.

A number of press reports refer to air pollution problems in the Taibach area of Port Talbot, and a petition of complaint about gases, grit and dust from the Margam works of the Steel Company of Wales, signed by 2,500 residents has been received. Mr. G. A. Morgan, Chief Sanitary Inspector, reported deposits in this area of 459.8 tons per month. The trouble is apparently due to emissions from the coke ovens, and the chief engineer of the company has stated that experiments were being made in an effort to solve the problem.



The Loray Fire

A new inset fire, introduced by Radiation Ltd., and selling at only £3. It is shown with the extension plate (extra) in the overnight burning position. It will burn any type of domestic solid fuel. Details from Wilsons and Mathieson Ltd., Leeds, 12, or Radiation Ltd., Stratford Place, London, W.1

Scottish Request

The Scottish Fuel Efficiency Committee decided at a recent meeting in Glasgow to approach the Department of Health for Scotland to examine the smoke abatement position in Scotland. Sir Patrick Dollan, the Chairman, said afterwards that Glasgow and Edinburgh had small local powers but that nothing had been done for more than twenty years in the way of legislation to deal with the problem.

Nutty Slack

Stop Press

A Sub-Committee appointed by the Technical Committee of the Society to consider the air pollution implications of the extended use of small rough coal, now termed Nutty Slack, reports as follows:

1. The reasons for attempting to popularize such fuel on the domestic market are recognized, but it is nevertheless to be regretted that a policy should be adopted which is so much at variance with the recent recommendations of the Ridley Committee and the opening sentence of the memorandum of the National Coal Board included in their report.

2. The smoke emission from slack burned in open domestic grates will probably be considerably greater than that from any other type of coal, especially when it is used for banking the fire. In such a fire the fuel slowly carbonizes or smoulders, rather than burns, with a considerable emission, at a relatively low temperature, of volatile matter in the form of smoke of high tar and oily matter content.

3. Apart from the atmospheric pollution consequences of such smoke emission, the radiation efficiency of such fuel is markedly less than that of any other domestic fuel. (One-sixth less, according to Fishenden, page 68, *The Coal Fire*). In addition, the wide-spaced firebars of modern open grates must cause greater losses through the unburned fuel falling into the ashpan. Such grates may indeed be the least suitable for the burning of slack. If, however, the fuel has to be used, smoke emission may be reduced by burning it on a bright fire and mixing with larger coal or smokeless fuel to promote the ignition of the volatile matter.

4. We are of the opinion that the Society would be failing in its duty and purpose if it did not make known the importance of this matter from the viewpoint of public health, amenities, and, especially during the winter months, of the prevalence of smoke-fog.

TOP MARKS FOR NELSON

If points were awarded for local activities in smoke abatement, there is little doubt that Nelson, Lancashire, would at present be at the top of the table. The Nelson and District Smoke Abatement Advisory Committee has arranged a full programme of monthly lectures for the winter session, including an address by Mr. Anthony Greenwood, M.P., and meetings first in the Gas, and then in the Electricity Showrooms. Publicity—an important necessity—has been obtained at minimum expense by such means as the distribution, gratis, of handbills by gas meter readers, the agreement of the local transport undertaking to exhibit posters in their buses, and the showing of advertisement slides in local cinemas—again all without charge!

On the more technical side the Committee has been promoting investigation of a locally designed modification of the Fuel Research Station smoke eliminator door, for use with the balanced-draught sprinkler stokers that are widely used in the district. Drawings and details are available from the Committee.

It is reported that to lessen smoke pollution from colliery chimneys the National Coal Board will install 57 more mechanical stokers at pits in the North Eastern Division before the end of the year. Work is also proceeding on the electrification of a number of pits.

In a letter to the *British Medical Journal* of November 8th, Dr. J. K. A. Bleasdale (who contributed the article on the effects of pollution on plant growth in our Summer, 1952, issue) makes suggestions on the possibility of sulphur dioxide in the atmosphere being an influence in the promotion of lung cancer. The suggestion is based on the possible parallel between the action of sulphur compounds on the cells of the lung tissues and that observed in the case of plants.

Impressions of the Portsmouth Conference

Contributed by a Delegate

Wednesday, 24th September

Although a regular visitor to other conferences for a number of years, this was my first attendance at one arranged by the National Smoke Abatement Society. The conference brochure gave a sense of pleasing anticipation and advance proofs of papers to be read seemed to augur well for a series of useful discussions on various aspects of atmospheric pollution.

Half a gale was blowing up the Solent as a few of us from the hotel made our way to the Conference Hall. This was a boisterous welcome and no mistake! By eleven o'clock, the official time for opening Conference, delegates were rapidly filling the vacant seats in the front of the hall. Having settled themselves in, they listened attentively to the Civic Welcome offered by the Lord Mayor of Portsmouth (Alderman A. Johnson, J.P.). Not to be outdone, it seemed, by the gusty elements outside, he gave a bright and breezy address, putting Conference into good humour with quip and jest, but did not omit to mention one or two home truths. His reminder that the country generally was too *casual* in its approach to the subject of smoke pollution hit the news headlines later in the day.

The President (Alderman F. E. Tylecote, M.D.), after returning thanks to the Lord Mayor, introduced his address in which he outlined the course of smoke pollution and its prevention since the 17th century. He " praised famous men " who in their day and generation raised a protesting voice against the " clowds of smoake " from burning coal. John Evelyn, the 17th century diarist and author of *Fumifugium*, naturally had special mention. Evelyn's silhouette, the Society's symbol, had a place of honour over the platform. Maybe from his niche in the Elysian Fields, he looked approvingly upon the efforts of his 20th-century successors.

As delegates assembled for the afternoon session, there was a counter-attraction seawards as two world-famous ocean liners passed up the Solent. These mammoths of the sea are a rare spectacle for the land-lubber: they seemed to dwarf even the Isle of Wight!

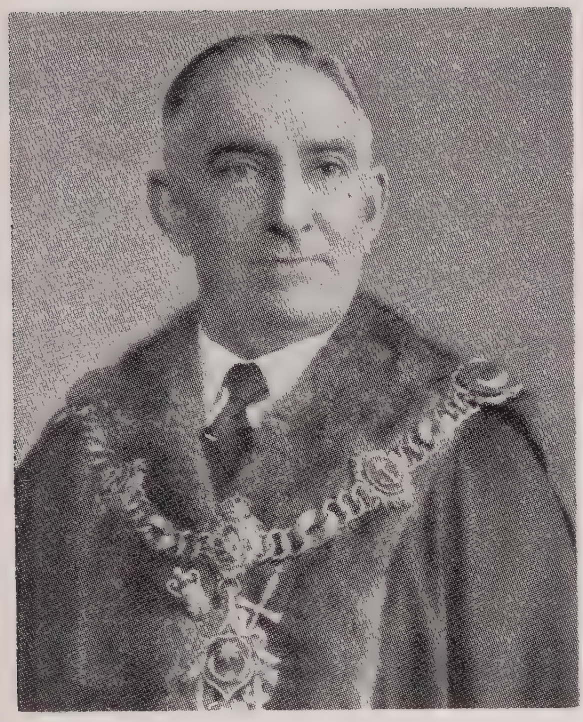
Under the chairmanship of Mr. S. N. Duguid, the third Des Voeux Memorial Lecture on " Smoke and the Law " was given by Mr. Hornby Steer, Counsel to the Society. He, too, delved into the realms of history to produce a paper suited to the occasion. In accordance with customary practice, there was no discussion afterwards, which in a way was a pity, because a paper of this calibre undoubtedly posed a question or two which someone might wish to raise. Conference adjourned soon after 3.30 p.m.

At eight o'clock delegates again assembled in the Pier Minor Hall, not for business this time, but to enjoy the hospitality kindly provided by the Lord Mayor and Corporation. Following the Civic Reception, dancing was indulged in by most of the company until a late hour. During the evening an excellent cabaret show was staged by a number of artistes, all of whom were roundly applauded at the conclusion of the performance.

This was a most enjoyable evening.

Thursday, 25th September

It was the turn of the Royal Navy



Alderman Albert Johnson, J.P.
Lord Mayor, City of Portsmouth

to provide a diversion for those taking a morning stroll along the Southsea front. Stroll is perhaps a misnomer, for the wind blew harder than ever, and rain showers sent people scurrying for shelter. A submarine and other small craft were making their way into Port on return from exercises in the North Sea. An aircraft carrier, American I believe, was riding the heavy seas while at anchor off the Isle of Wight.

The morning session was under way soon after ten o'clock under the guidance of Alderman J. Chapman, M.B.E. (Newcastle). Delegates listened to six speakers giving a series of " Progress Reports " connected with work of smoke abatement. With an American guest speaker, Scotsmen, Welshmen and Englishmen taking part there was quite an international flavour about the proceedings. It was pleasing to see a lady delegate, Alderman Mrs. Ethel Hanley (Widnes), take a leading part. She recorded the activities of Advisory Committees in Lancashire, and gave a good account of herself—as did, of course, all the others who contributed papers. No less than fifteen speakers occupied the session which did not close until well past twelve o'clock.

Another diversion before the afternoon's business. The R.M.S. " Queen Elizabeth " hove into view soon after two o'clock, outward bound from Southampton: the 3d.-a-peep merchant who hired out a large pair of binoculars for a close-up of the gigantic ship, did a brief but brisk trade.

Councillor F. Miles, J.P. (Portsmouth), was chairman in the afternoon. Two papers on " Incentives for Smoke Prevention " were presented; one by W. L. Mather, a member of the Executive, who spoke on the Industrial side, and Dr. Martine (Birmingham), who is a deputy chairman of the Executive. Dr. Martine concerned himself with domestic smoke. During this discussion, I reflected that in the past the need for industrial smoke abatement had tended to overshadow efforts to overcome the domestic smoke evil. This is no longer the case, as evidenced by the equal prominence given to both in the afternoon's discussion. Those concerned with the health of the people cannot ignore the hypothesis of so eminent an authority as Dr. Percy Stocks that " atmospheric pollution by domestic smoke is an important factor in the genesis of lung cancer."

Three resolutions were down for discussion at the close of this session. The first, recommended by the Executive, dealt with creation of smokeless zones and availability of solid smokeless fuels. It was non-contentious and received approval. Wrexham R.D.C., moved the third on the order paper, asking for training and certification of stokers, etc. This was also approved but not before a dissentient had read into the resolution some hidden purpose.

The second recommendation from the Executive seemed innocuous enough on the first reading, being merely a plea for a smoke-free atmosphere on Coronation Day next year. H. Hornby (Batley), thought the resolution was not in good taste, and said so to such purpose that he carried Conference with him, the resolution being lost. I think he was right. The purport of the motion will in any event be largely met by circumstances. Being summer-time, and Coronation Day declared a bank-holiday, domestic fires will be few in number and industry closed down.

Friday, 26th September.

The chair at last session of Conference was taken by Sir Ernest Smith, Honorary Treasurer of the Society. He introduced Professor R. J. Sarjant to speak on " Pollution problems of the Iron and Steel Industry." Dr. Sarjant illustrated his talk with slides, showing a number of technical processes referred to in his paper. This was obviously an occasion when the experts would have it all to themselves. J. Law (Sheffield), was disappointed with some of the speaker's conclusions: he thought that the *qualified* exemption of the iron and steel industry from the nuisance provisions of the Public Health Acts should be repealed. Dr. Colclough (Iron and Steel Federation), in a very reasoned statement, gave an insight into the magnitude of the task facing the industry. They were an eye-opener to me and must have been to many other delegates also. Dr. Colclough made a plea for tolerance, patience and understanding.

At the conclusion of this most interesting discussion, Conference resolved itself into the Annual Meeting of the Society. Formal business was quickly disposed of, the main point of note being that approval was given to increased rates of subscriptions as recommended by the Executive.

The customary vote of thanks to those whose efforts had contributed to the success of Conference was put by F. J. Redstone, (Bristol), a deputy Chairman of the Executive Council, and carried with acclamation. On this happy note the proceedings were brought to a conclusion.

Before leaving for home, many delegates took advantage of the opportunity to visit H.M.S. "Victory" Nelson's famous ship of the line; nowadays the Flagship of Commander-in-Chief, Portsmouth.

Afterthoughts

One's impression of the Conference is that it forms an important forum for expressing many views that must be aired if the work of smoke abatement is to be seen in proper perspective and balance. Delegates from local authorities (and I write as one of them), must have derived benefit from hearing what the industrialists had to say. In reciprocal manner, the technical experts in industry should be

Conference Platform

Snapshot of part of the Thursday morning platform. Left to right: Prof. F. E. Tylecote, President; Henry Burn, of Los Angeles; S. N. Duguid, Executive Chairman; Alderman John Chapman, Sessional Chairman able to appreciate more fully the responsibilities of Councils and their officers.

It is clear that the aims of the Society are becoming increasingly known, in local government and industrial circles alike, and the measure of support for its efforts to secure a clean atmosphere ought to increase accordingly.

CONFERENCE RESOLUTIONS

The following resolutions were adopted unanimously at the Portsmouth Conference in September:

(1) THAT this Conference welcomes, among other proposals that will promote smoke prevention, the recommendations of the Ridley Committee for the setting up of further smokeless zones and the increased production of solid smokeless fuel. Accordingly, and in view of new evidence that the dangers to health from domestic smoke may be greater than have previously been recognized, the Conference urges the Minister of Housing and Local Government to grant permission for the establishment of proposed smokeless zones; urges the Minister of Fuel and Power to do everything possible to develop the availability of smokeless solid fuel of all kinds for domestic purposes; and invites all local authorities to support these requests.

(2) THAT all persons who have charge of the operation or maintenance of power plant, whether steam, oil, gas or electrical, should possess sufficient theoretical knowledge and practical experience, eventually to be recognized by the holding of a certificate, to ensure that such plant shall be worked with maximum efficiency and safety.

The Conference Makes News

The Portsmouth conference was widely reported in the Press, and well over 350 cuttings have been received. There was also an excellent report by Godfrey Talbot on the B.B.C. 7 p.m. news in the Light Programme on the opening day. The two items that received most publicity were the reference in the President's address to the £62½ millions value of the sulphur sent up our chimneys each year, and Dr. Stocks's important paper on smoke and lung cancer, which is reprinted in full in this issue.

This paper was discussed at length in a leading article in the *British Medical Journal* of November 1st, and this in its turn led to a leader in the *Manchester Guardian*. Both papers agreed that the case against domestic smoke as a factor in the incidence of lung cancer, though strong, cannot be regarded as proved. However, said the *Guardian*, "local authorities should not wait for final proofs before taking more vigorous action against smoke pollution."

The Medical Officer, in an appreciative editorial on the conference, concluded with a paragraph that we would like many people to ponder over:

"The cost of the curative health services has been a headache to the Government and various expedients have been adopted to lessen it whilst, in the midst of an acute national shortage, old houses are rapidly being reduced to slums by a combination of financial causes on the one hand and atmospheric and pollutant factors on the other. Here is again an example of the truth of the statement that prevention is not only better but cheaper than cure and yet, whilst the economic wealth of the nation can be so flagrantly dissipated, impoverished governments are unable to find a direct grant of a few thousand pounds annually to help the National Smoke Abatement Society in its task of cleaning the atmosphere which is left to subsist on the annual subscriptions from industry, local authorities, and such discerning citizens as the Lord Mayor of Portsmouth."

Meetham's "Atmospheric Pollution"

A New Text-Book

Atmospheric Pollution: Its Origins and Prevention. By Dr. A. R. Meetham. 8vo., pp. 268. Pergamon Press London. 35s. net.

DR. A. R. MEETHAM, who for a number of years was well-known and well-liked as Superintendent of Observations, Investigation of Atmospheric Pollution, at the Fuel Research Station, has now left air pollution work for other fields of activity. He has however, done the movement one more valuable service by writing this important new volume on the subject. To cover the whole, or the most important aspects, in a single slim volume is no easy task, and the author is to be commended for the balance he has achieved, and for the conciseness and clarity with which he has dealt, on a fairly technical level, with the many factors that must be considered in any survey that aims to be reasonably complete.

The book is not, and was clearly not intended to be, one that will capture the interest and awaken the enthusiasm of the uninitiated. It is a book of information and reference for those who are already studying the subject or are working on it in a practical or professional way.

After an introductory chapter the author deals with the origin of fuel, natural fuels, and artificial fuels. Then follow chapters on industrial boilers, power and electricity, industrial furnaces, and domestic fires. Next there is a survey of atmospheric pollution—what it is, its measurement, distribution, and the changes in its concentration that occur. The effects of pollution are reviewed very briefly, and a chapter on the prevention of pollution deals in a clear manner with the principles and technical means that may be used, although not in any way with the now bigger problems of how to encourage and ensure that these means shall in fact be used. The final chapter is a useful guide to existing legislation and the way it is administered. The account of the Alkali, etc., Works Act, 1906, and lists of works required to be registered is particularly useful as this information has not been included in such detail, as far as we know, in any other recent reference book.

Mention must be made of the 81 illustrations contained in the book, most of which are line diagrams and charts. They add much to the value of the work.

To the reviewer, at any rate, one of the most interesting chapters is the introduction, where the author had felt free to express his own feelings and opinions, compared with his strict objectivity elsewhere. A number of passages could be quoted from here, and the following in particular is most revealing in its facts and the way in which they are expressed:

" There would seem to be little danger in discharging a small quantity of pollution into the open, where it is so much diluted that it quickly becomes harmless. In one square mile there are about 30,000 tons of air below roof level but, when it is realized that as little as one part per million, i.e., 0.03 ton of pollution in 30,000 tons of air, is sufficient to make the air unpleasant to breathe, a simple calculation will show how quickly such a quantity of air may be seriously polluted. In one square mile of a town, it is not uncommon for a ton of coal to be burnt every minute, and on an average each ton of coal produces about 0.05 ton of pollution, including solid particles and gases such as sulphur dioxide, but not counting carbon dioxide. If all this pollution is emitted into the atmosphere, as it usually is, it is enough to cause serious pollution in the air below roof level in 36 seconds. Usually, of course, much of the pollution spreads above roof level and cleaner air is continually being brought in from outside the town and above it; but if this natural ventilation were to fail, it can be calculated that we should be gasping for breath in half-an-hour, and dead in ten hours."

If your concern with air pollution is serious and practical this book is a " must " for your bookshelves.

The U.S.A. Technical Conference Report

Air Pollution: Proceedings of the United States Technical Conference on Air Pollution. Sponsored by the Interdepartmental Committee on Air Pollution; Louis C. McCabe, Chairman. Crown 4to., pp. 847. McGraw-Hill Book Company, Inc., New York and London. £5 6s. 6d.

THE first impression one has of this volume is its sheer size and weight. It is easily the biggest publication ever on air pollution, and is unique in the extent of the field it covers. It is the record of the Technical Conference held at Washington in 1950, convened as a result of a direct request from the President himself for more study and action on the subject.

All the 97 papers are included, together with reports of the general sessions and the discussion, mostly brief, that followed the individual papers. To refer to the papers separately would mean only a lengthy catalogue, but the scope of the conference, and the attention given to the different aspects of the problem, can readily be shown by listing the seven panels into which the meetings were resolved, with the number of papers read to each:

Agriculture	14
Analytical Methods and Properties	14
Equipment	24
Health	14
Instrumentation	14
Legislation	9
Meteorology	8

Particular points of interest that stand out include the examination of the effects of sulphur oxides and fluorides on plant life in the Agricultural Panel; the considerable attention given to the filtration of dust and grit from flue gases in the Equipment Panel; and in the Health Panel reviews of factors that have received little attention in this country, such as the effects upon the skin.

Two British contributions should be noted—" Instruments Used for the Measurement of Air Pollution in Great Britain," by Dr. A. Parker and Mr. S. H. Richards of the Fuel Research Station, and " Legal Aspects of Atmospheric Pollution and Methods of Control used in Great Britain," by Mr. W. A. Damon, Chief Inspector of Alkali, etc., Works. Dr. Lessing, who is Chairman of the Society's Technical Committee, was present at the conference and his contribution to the discussion is included in the report.

The price of the volume will no doubt deter all but a few individuals in this country from purchasing personal copies, but it should certainly be in the libraries of all organizations and public authorities that take air pollution at all seriously. There is much factual information that will be new to many, and for reference purposes many of the papers will be valuable for years to come. What is more, the direction of thought, the ways of approaching and examining the problems, being subtly different in many cases from our own, will be found to be stimulating to the British reader's own concepts and opinions.

Report on Fuel Research

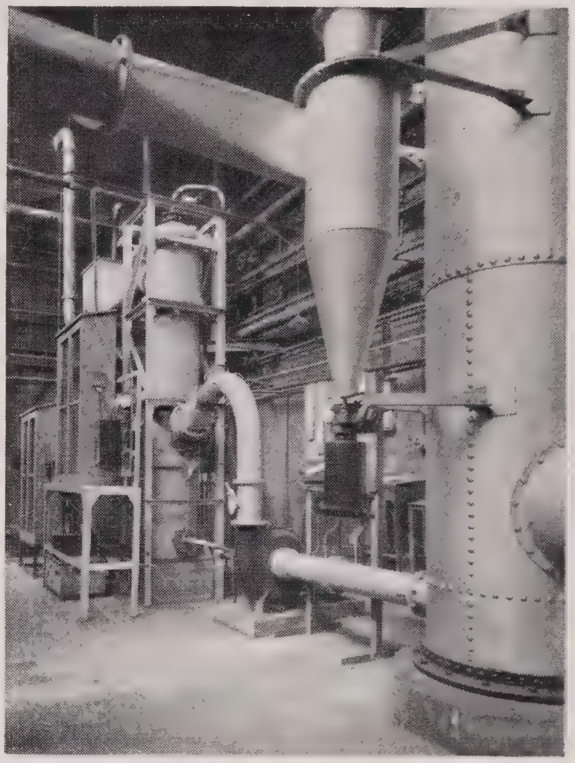
Fuel Research 1951. Report of the Fuel Research Board, with Report of the Director of Fuel Research. 8vo pp. 60. H.M. Stationery Office, London, 2s. 6d. net.

ONE of the fundamentally most important problems discussed in this report, and on which the Fuel Research Station is working, is that arising from the growing shortage of supplies and reserves of the best coking coals used to provide coke for the metallurgical industry. The blending of coals for carbonization to produce cokes of acceptable quality is an important way of conserving the scarcer coals, and the work carried out at Greenwich shows that as much as 30 or 40 per cent. of weekly-caking coal may be incorporated in the blends.

Work is being done on the gasification of small-sized non-caking coal by a fluidized-solids technique, using a small pilot plant to produce water gas. Pulverized fuel for gas turbines is another attractive possibility and is being investigated actively.

Smoke elimination continues to be one of the factors included in work on boiler efficiency, and this is now being applied to the vertical type of boiler.

The work on the Fulham-Simon-Carves ammonia process for the removal of sulphur compounds from boiler flue gas and the recovery of the sulphur as ammonium sulphate and elemental sulphur has received an added incentive, not only from the continued shortage of sulphur, but also from the rise in price of sulphur and its compounds which has made the process less costly than was at one time thought. Experiments in the small pilot plant which treated 1,000 cu. ft. of flue gas an hour have been completed satisfactorily. A larger unit to treat 25,000 cu. ft. an hour has been built and work with it has been started.



Removal of sulphur compounds from flue gas. Experimental plant at the Fuel Research Station for the Fulham—Simon-Carves process

The section on atmospheric pollution is full of interest, and a table shows how the numbers of observations now being undertaken have increased. In 1951 there were 408 deposit gauges in operation, with 487 lead peroxide instruments for sulphur dioxide measurement, and 78 daily smoke filters.

Regional Survey of Sulphur Dioxide

An account is given of the survey in the south-west London area, begun in 1945, with the object of studying the effects of the restoration at the

Battersea and Fulham generating stations of processes for removing SO_2 from the boiler flue gases. Maps show that the heaviest sulphur pollution in the two districts is centred round the generating stations, extending north-eastwards along the line of the prevailing wind.

A first appraisal of the results obtained in this investigation, says the report, has indicated that so far there has been no reduction in the concentration of sulphur dioxide in the air over the south-west London area resulting from the reinstatement of the flue-gas treatment process at the Battersea generating station. It should be noted, however, that during the period of the survey, there has been a considerable increase in the overall consumption of fuel by both the Battersea and Fulham stations, which may have obscured any advantageous effects arising from the re-introduction of the flue-gas treatment process. It is intended to continue the survey until the whole of the flue-gas from Battersea is washed.

Reference is made to other similar surveys being carried out in the Kingston, Croydon, East London, and Staythorpe (Nottinghamshire) areas.

NEW LEGISLATION CONSIDERED UNNECESSARY

In the House of Commons, 21st October, 1952:

Mr. Edward Davies asked the Minister of Housing and Local Government whether he is satisfied that local authorities have adequate powers to deal with the industrial smoke nuisance in their localities; and whether he will take steps to strengthen these powers to assist them in their fight for a clearer atmosphere.

Mr. H. Macmillan: Local authorities have wide powers for the prevention of smoke nuisances under the Public Health Act, 1936, and, while I am anxious to assist, I do not think that further legislation is necessary at present.

ALUMINIUM FOR TALLER CHIMNEYS

Although tall chimneys do not prevent smoke they are becoming recognized as an important means for dispersing the inevitable fumes from flue gases more effectively into the atmosphere. (See S.P. Abstract 190, page 179, of our Summer, 1952 issue). The cost, weight, and maintenance of tall chimneys are however serious factors involved. Now, we learn, a self-supporting tapered aluminimum chimney, which can be built to great heights, has been designed by Aluminium Construction Ltd., Sheerwater Estate, Woking, Surrey, in collaboration with Professor S. C. Redshaw, D.SC., of Birmingham University. The design incorporates a special type of asbestos insulation lining, made by the Cape Asbestos Company Ltd., which will reduce the temperature near the aluminium to working limits.

Vents are provided at various levels, so that currents of cold air can pass between the lining and the aluminium and so help to keep the latter relatively cool. The chimney proper is built from fluted aluminium extrusions which are riveted together on the inside and kept in shape by horizontal rings. The latter are also used to support the lining, which will be in panels for ease of handling and replacement.

It is estimated that the time required to erect a 300 foot chimney will be about three months after the foundation is cast. A point of interest is that with aluminium only 3 per cent. of its carrying capacity is used to hold itself up, whereas in concrete this amount is 33 per cent. A 300 foot chimney with its insulation will not weigh more than 100 tons. This should be a point of interest where chimneys are erected at distances from sources of supply of orthodox materials. The aluminium alloy used is resistant to most flue gases and industrial atmosphere. It will weather very quickly and the fluted appearance is pleasant. Maintenance should be negligible.

THE DIVISIONS

A joint meeting of the North Western Divisional Council and the North Western Section of the Institute of Fuel was held in Manchester on October 13th. An address was given by Dr. J. C. Weston, of the Building Research Station, on " House Heating." The speaker described recent experimental investigations in houses at Abbots Langley and elsewhere, explaining the method of carrying out the trials, remote recording, tenant rotation, etc. The effects of tenant habit—window opening, water consumption, economic factors, and so on—were discussed. The results obtained gave important information on the importance of insulation, the use of a single solid fuel appliance for main space heating in summer, cooking, overnight burning, and the comparative performance of coke and coal. (An editorial comment on the address is made on page 54).

On November 13th the East Midlands Division met at Derby—the first meeting to be held in the town—at which Dr. M. Barash, a member of the Society and Coke and By-Products Officer of the East Midlands Gas Board, gave a paper on " Smoke Abatement with Fuel Economy in the Home." During the morning a tour was made of the Litchurch Gas Works, Derby, and demonstrations were given of smokeless domestic heating appliances, followed by lunch by invitation of the East Midlands Gas Board.

The Yorkshire Division held its Annual General Meeting in Leeds on November 28th. After the business meeting an address was given by Arnold Marsh, General Secretary of the Society, on " Problems and Prospects in Smoke Prevention." The meeting concluded with the showing of the excellent Babcock and Wilcox film, " Pulverized Fuel."

The West Midlands Division held a joint meeting with the Electrical Association for Women in Birmingham on November 27th. Papers were read by G. W. Farquharson on " The Need for Smoke Abatement, and by C. Nield, of the Midlands Electricity Board, on " Industrial and Domestic Uses of Electricity towards Smoke Abatement."

A feature of all these meetings has been the excellent attendances.

FROM THE U.S.A.

The now annual " Cleaner Air Week " was held in the U.S.A. and Canada from 20th to 26th October. It is sponsored by our friends the Air Pollution Control Association, and enjoys the co-operation of the United States Department of Commerce and many organizations actively interested in air pollution problems. Its purposes are described as " to promote a united educational programme for cleaner air and to help build a better and stronger America."

We have received the November issue of the Association's quarterly *Air Repair*, which with its sixty quarto pages contains plenty to read. There is an interesting article about the Ringelmann of the well-known smoke density chart. Vaguely we had thought of him as an American, but he was in fact French—Maximilien Ringelmann, Professor of Rural Engineering at the National Agricultural Institute, and a well-known figure in French scientific life in the early part of the century. The magazine also features an article entitled " Journeys Round Britain," by the Secretary of the N.S.A.S. This is an account of the visits he made this year to the various Divisional conferences, and is more of a travel diary than a smoke abatement article. (If any reader would like a copy, a few reprints of the article are available). The international flavour of *Air Repair* is maintained by articles on the smoke problems of Beunos Aires and Japan.

Air Repair is to become a more technical quarterly, and from January, 1953, there is to be published a monthly magazine, *APCA News*, devoted to current news and developments.

AIR POLLUTION AND CORROSION

Important New Tests show Close Correlation

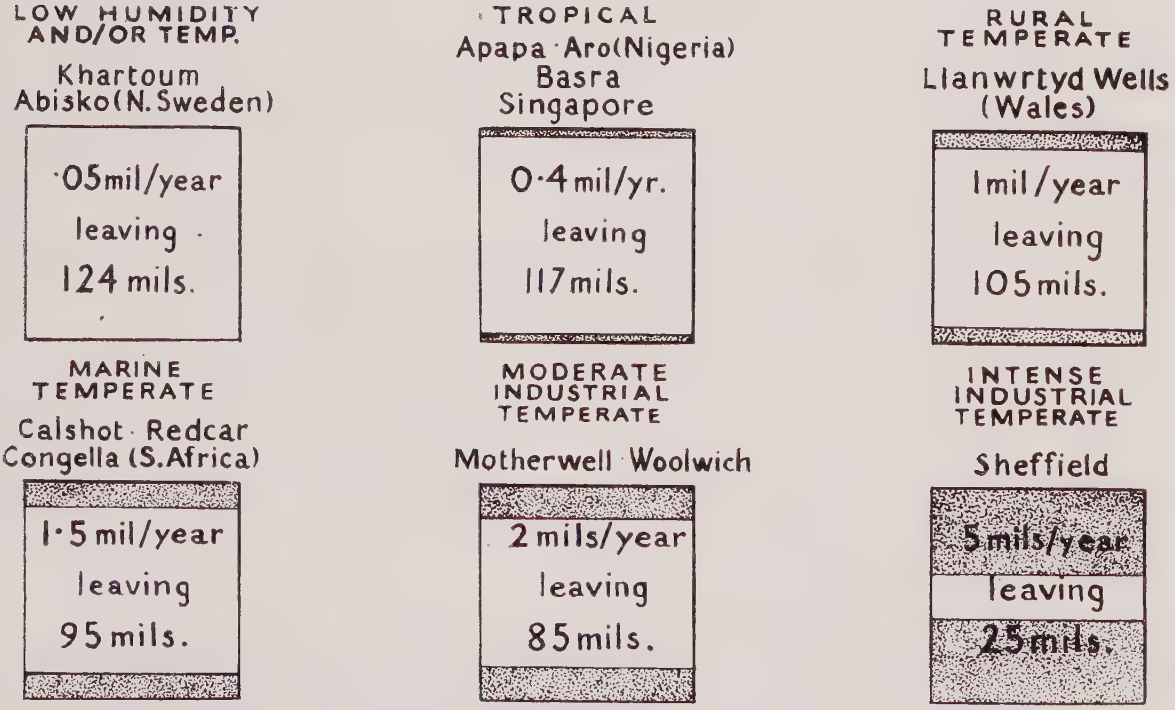
Early in 1951 arrangements were made to correlate the rates of corrosion of reference specimens of zinc and copper-steel with the pollution of the atmosphere by sulphur dioxide. The Fuel Research Station, D.S.I.R., collaborated with the British Iron and Steel Research Association in this research by recommending sixteen suitable sites where routine determinations of sulphur dioxide are being made, and by rendering assistance with the exposure of some of the specimens. The sites were selected to represent four degrees or increasing pollution: slight, moderate, heavy, and severe, each degree being represented by four sites.

Two zinc and two copper-steel specimens were exposed alongside the lead peroxide instruments at each station for one year. The lead peroxide cylinders used for the sulphur dioxide determinations are changed monthly and their sulphate contents are found by analysis. The averages of the twelve monthly sulphate determinations were compared with the losses in weight of the zinc and steel specimens exposed for the whole year.

The extent of corrosion in each of the four types of station is clearly shown in the accompanying diagram, but more important is the close degree of correlation between the three sets of figures for the sixteen exposure sites, which shows conclusively that *the sulphur dioxide concentration in the air is the primary factor determining the intensity of corrosion in Great Britain.* The correlation coefficients (Spearman) are as follows:

	Sulphate collected	*Corrosion of*	
		Cu-steel	*Zinc*
Sulphate collected	—	0.98	0.97
Corrosion of copper-steel	0.98	—	0.95
Corrosion of zinc	0.97	0.95	—

A paper describing this work in


LOW HUMIDITY AND/OR TEMP.
Khartoum
Abisko (N. Sweden)
·05mil/year leaving 124 mils.
TROPICAL
Apapa · Aro (Nigeria)
Basra
Singapore
0·4 mil/yr. leaving 117 mils.
RURAL TEMPERATE
Llanwrtyd Wells (Wales)
1 mil/year leaving 105 mils.
MARINE TEMPERATE
Calshot · Redcar
Congella (S. Africa)
1·5 mil/year leaving 95 mils.
MODERATE INDUSTRIAL TEMPERATE
Motherwell · Woolwich
2 mils/year leaving 85 mils.
INTENSE INDUSTRIAL TEMPERATE
Sheffield
5 mils/year leaving 25 mils.

An illustration from "The Fight Against Rust," mentioned above, showing the rate of corrosion in different climates. The diagram refers to the effect of 10 years' exposure on a $\frac{1}{8}$ in. thick mild steel plate detail is to be read by Dr. J. C. Hudson and Mr. J. F. Stammers at a meeting of the Corrosion Group of the Society of Chemical Industry at Nottingham on 5th February, 1953, and a report will be published by B.I.S.R.A.

We should like to take this early opportunity of congratulating B.I.S.R.A., its Corrosion Committee, and Atmospheric Corrosion Subcommittee, on the one hand, and the Fuel Research Station on the other, on the important outcome of their collaboration, and of stressing the importance of the results to the smoke prevention movement. That the acidity of our polluted air accelerates the corrosion of metals has, of course, long been known, and what few experiments have been carried out in the past have shown, roughly, that corrosion increases with the intensity of pollution. But not until now has such an accurate series of tests shown, and even given mathematical proof, of the closeness of the relationship.

Allied to this report is a new publication issued by the British Iron and Steel Research Association. It is *The Fight Against Rust* (large 8vo., pp. 25, 2s. 6d. net). This is a general illustrated account of the work of the Corrosion Committee of the Association, and is a most attractively produced brochure. The cost of rust to Great Britain is estimated to be £200,000,000 a year, but air pollution is of course only one of the responsible factors. Rusting occurs in moist air, on under-water surfaces, and on surface buried underground. There is a sub-committee for each of these questions, and other sub-committees deal with protective coatings and methods of testing.

The importance of polluted air is well-stressed in a diagram, which we reproduce, showing the rate of corrosion in different types of climate. It speaks for itself.

The Laboratory and Staff of the Coal Makers' Association

(*Cartoon conceived by S. N. Duguid, drawn by Dorothy Rowlinson*)

The Fuel, Power—and Ridley—Debate

Extracts from Speeches in the House of Commons 28th October, 1952

The Minister of Fuel and Power (Mr. Geoffrey Lloyd): I am sure the House would like to know that there has been some really remarkable progress in the production and distribution of the improved grates during the present year. Some Hon. Members may remember that when we had our debate in March, I told the House that it looked as if about 900,000 of these appliances would be produced during the year. I am glad to say that it now looks as if we shall have about 1,700,000 of these appliances during this year. This compares with a figure of only 200,000 three years ago. It is a 700 per cent. increase. The figure has now reached the position where it is significant in relation to the number of households in the country.

In recent years the proportion of large coal has been falling by about one per cent., which means that on a production of 200 million tons we would get every year two million tons less of large coal. Even when there is an increased production—as was the case last year, when we had a very considerably increased production of coal as a whole—there was no increase in the amount of large coal because of the operation of the factor I have just mentioned.

Three things are happening, if I may put the matter in a simple, straightforward way. First of all, large coal is scarce and is particularly valuable for export purposes. Secondly, the graded varieties of the smaller sizes of coal are in short supply, but not so scarce as the large coal. Thirdly, the small coal—and I know that mining members will excuse me if I try to define this with great care—which is what remains after the larger varieties of coal have been taken out, is in quite good supply.

The Right Hon. Gentleman, began, and I continued, the allocation of a certain amount of the graded smaller sizes of coal to the household coal market. Of course, the English householder has for generations been accustomed to the large coal. As we know, the coal I have in mind looks a little different, because it is smaller; but it is good coal—let us make no mistake about that. This is not the bad or dirty coal we have heard about; it is good coal except that it is smaller coal. The modern grates, of course, have been particularly designed to burn this coal, and they do so with great efficiency. As a matter of fact, I have heard of only one fault with the graded varieties, and it is that the smaller sizes are inclined to burn rather quickly. But that is very easily corrected if one has some small coal to put on.

Here, I think, we have an opportunity to help every coal consumer in the country to a certain degree, and especially those with modern grates, by reason of the good supply at present of rough small coal. From 1st December, therefore, I propose to free the sale of this rough small coal from all restrictions. There will be no limits on the amounts of this kind of coal which anyone can buy . . The technical description of this coal, I am advised, is untreated smalls, below ¾ inch.

I have one more piece of good news for householders, and it is that stocks of coke are good, and I am able to increase the maximum amount of boiler fuel which householders can buy during the six winter months from November to April from 20 cwts. to 30 cwts., provided the extra is taken in coke.

Mr. Philip Noel-Baker: On domestic heating, again the (Ridley) Committee take the test of thermal efficiency. Domestic heating uses 35 million tons of coal and 4.2 million tons of coke. But the Committee find that coke has a far higher percentage efficiency than coal. In the old-fashioned grate coal may be as low as 20 per cent. efficient; with coke it may be from 35 to 40 per cent. up to 60 to 70 per cent. Now, there is a rapidly growing domestic demand for coke, as I found 18 months ago. Coke is smokeless; it avoids the pollution of our towns and country, which before the war cost us nearly £50 million a year. The Committee, therefore, I think rightly, say that coke production should be increased.

The same arguments apply to other smokeless fuels—Coalite, the Coal Board's " Phurnacite," their best briquettes, and others. I believe that increasing the production of coke and these other fuels ought now to be a major objective of policy for the Government, for the National Coal Board and for the Gas Boards, and they should all work together to get a quick and a large result.

I am convinced that there ought to be far fewer types of these improved appliances. What is the good of having a training course for employees who sell these appliances and in three days showing them 150 types? What can they learn about 150 types. It should be 15 at the outside. In any case, there ought to be fewer.

Mr. George Darling: I did suggest that, domestically, we should stop the burning of raw coal when I was speaking in the debate in March, and I still stand by that. We have to go ahead with putting in modern stoves for water heating, modern fires and modern appliances for saving fuel in fires as quickly as we can. We want better and cheaper appliances, and, in the end, we want to burn coke and solid fuel in them and stop domestic consumers burning raw coal. They will get better service. There will be less pollution of the atmosphere, and consumers will get far more value from the coal that the miners are producing.

Mr. Ellis Smith: I spent last Sunday making an analysis of the Report, and I want to make some observations on it. On pages 92 and 93 the Committee make some very enlightening observations about smoke abatement. Nowhere in this country would smoke abatement be more welcome than in the city of Stoke-on-Trent, especially near the tileries in Trentham, Blurton, Longton and Burslem, and near the potteries in Fenton and Longton. Thousands of our countrymen have needlessly suffered the undermining of their health because of lack of a smoke abatement policy. In many areas in those districts the people dare not even have their windows open. We welcome this proposal.

When the Minister gives further consideration to these proposals, he should consider whether the local authorities ought to be given more authority to deal with the problem and whether there should be more inspectors with greater authority to take action.

Mr. Gerald Nabarro: I pause here to offer a word of warning to many people—Hon. Members of this House and the general public outside—who think that fuel efficiency solely means installing modern appliances in our homes. In fact, that is a form of fuel efficiency, and a very desirable one, but installing modern solid fuel appliances will not make, in my view, a contribution of a single ton of coal towards the balancing of our coal budget and increasing exports. By installing modern solid fuel burning appliances in our homes all that immediately happens is that these appliances make the ration go further, and any coal saved results in increased standards of domestic comfort. It does not result in a tangible contribution to balancing our coal budget.

The substantial saving of coal must come from industry. The Ridley Report says that 15 to 20 million tons of coal could be saved each year . . .

(Later, referring to district heating): What we want is a small heat-cum-power station in a new town, using back pressure turbines feeding waste or latent heat in the form of steam to the factories and to the domestic dwellings in that town in order to test whether the Ridley Report is correct in saying that there is no great future for this type of district heating.

The Ridley Report does nothing better than gently, gently, to point the way towards a national fuel policy.

Mr. Horace E. Holmes: Appendix IV of the Ridley Report deals with smoke abatement. I served on a public health authority for many years and was chairman of a parks committee. Under the Miners' Welfare Scheme we developed a park which brought new social life to the community. We had gardens, putting and bowling greens and an open-air swimming bath. It was a beautiful piece of development. Later, because of a housing scheme, we had to abandon the open-air swimming bath, for it did not lend itself to being covered in. The bath might be filled with clean water one day and the following morning there would be such a scum of soot and grit on it that no one would use it. When the wind was blowing in a certain direction I have seen that beautiful park look as if a blight had settled on it.

I am anxious that Appendix IV shall be fully implemented, and I hope the Minister will co-operate fully with the Ministry of Health, the Ministry of Housing and Local Government and the local authorities. I urge the Smoke Abatement Society to have the second paragraph of the Appendix printed in red and sent to every house, every factory, every industry and every Member of Parliament in order to create a public opinion against the social evil and crime of smoke and soot pollution.

I read the other day that someone had assessed the weight of smoke, and it was expressed in millions of tons. Imagine what that must represent in grit and dust. Someone once said that the tragedy of the blind is that they live in a world without a sky. People in the industrial areas often live under a pall of smoke which obliterates the beauty of the sky. The Government and everybody else concerned should apply their minds to this matter so that the evil can be eradicated as quickly as possible.

Mr. A. Edward Davies: We know in North Staffordshire that many of our people have suffered from respiratory diseases. A man may have something wrong with his chest or his breathing apparatus because of working in the mines or in the potteries, or may be subject to bronchitis or have tuberculosis. We know how difficult it is for people living in these sulphurous poisonous atmospheres to get their breath and continue to live in any sort of comfort.

Although the problem has been considered for some years, we ought to press the Minister tonight to say he is not forgetting it, not only because of the great benefits which can be derived in the conservation of coal—a vital matter in itself—but because of the social value and social cost involved. The loss of sunlight and of ultraviolet rays, the loss of amenities, the damage to buildings and textile fabrics, the extra cost of the painting of premises and the loss in food production which results from smoke deposit in and around our towns, are surely matters of great urgency and importance . . . .

Dr. Barnett Stross: Would my Hon. Friend not accept that what he is saying is borne out by the fact that if one attempts to grow a cabbage in some of the sulphurous atmospheres he is describing its maximum size tends to be no greater than that of a brussels sprout?

Mr. Davies: I am indebted to my Hon. Friend, who is a medical man and knows a great deal about these matters; but he will know more about the respiratory complaints to which I have referred . . . . Much has been done in respect of smoke abatement, and I have noticed in the Ridley Report that, while it is permissable, under the Public Health Act, 1936, for local authorities to enact byelaws, only about one in five of the urban authorities have done so. What has happened to the other four-fifths? I asked the Minister of Housing and Local Government the other day whether he was satisfied that the local authorities had sufficient powers to do this job, and the Right Hon. Gentleman said he thought they had. I very much doubt whether they have sufficient resources at their disposal, in terms of advice and sanctions, against the people who infringe the law.

Mr. A. Roberts: I quite agree with (the previous speaker) that there is not sufficient power to deal with smoke abatement. That is not the fault of this Government alone, because all Governments have failed to do their job with regard to smoke abatement.

The Parliamentary Secretary to the Ministry of Fuel and Power (Mr. L. W. Joynson-Hicks): I would particularly mention the question of smoke abatement, which has been referred to by the Hon. Members for Stoke-on-Trent, speaking in happy harmony on the Opposition benches, which we so delight to see. I am happy to think that, of all places in England, it is in the Potteries where there has been the biggest advance in the use of gas in industry, and I hope that will prove to be a step in the right direction, and that the Hon. Members themselves will also take active steps to assist in and accelerate the fuel efficiency work in that industry which will help in relieving the smoke abatement problem which I know does exist there.

From our Photo-Library—15 *Aerofilms Ltd.*

Household Smoke—North East Coast

The B.E.A. Report, 1951-2

British Electricity Authority: Fourth Report and Accounts, 1951-2. 8vo., pp. 271. H.M.S.O., London. 10s. net.

THE fourth annual report of the British Electricity Authority shows that the British Electricity industry continues to expand at a phenomenal rate. 59,260 million units were generated against 55,577 million units in 1951, an increase of 6.6 per cent., while there were over 13½ million consumers, 426,000 more than in the previous year. The progressive expansion is well shown by increase from 4,295 million units in 1920, 10,676 million units in 1930, 28,137 million units in 1940 to the 1951-52 figure quoted above. The sales of electricity were 8.2 per cent. more than in the previous year, industrial consumption 9.9 per cent., domestic 7.1 per cent. and commercial 6.5 per cent. more than in 1951.

It is interesting to note that in spite of the increase in the price of coal (which was 11.1 per cent. higher than in 1951) plant, engineering works, etc., the average price of electricity at 1.220d. per unit was only 16.2 per cent. higher than that of 1938-39, which, among other factors, reflects the increase in efficiency of generation. The increase in overall thermal efficiency which has risen to 22.04 per cent. would have been even more pronounced had not the shortage of plant necessitated keeping in commission some of the older small generating sets, many of which were over 25 years old. During the year 119,000 kilowatts of older plant was shut down and at 28 power stations 33 new generating sets having a total capacity of 1,270,750 kilowatts were brought into service. Three of the new sets were diesel-engine driven and replacing small obsolete units, which although less efficient than modern steam-driven plant can be more readily installed. Ten new power stations, of which nine are fired by pulverized fuel, were brought into commission.

As "standard" plant 30,000 kilowatt sets with steam at 600 lb. per sq. in. and at 850° F., and 60,000 kilowatt sets with steam at 900 lb. per sq. in. and 900° F. are being installed in the current programme. At a new station at Castle Donnington six sets each of 100,000 kilowatt each supplied with steam at 1,500 lb. per sq. in. and 900° F. from a single boiler are projected.

The authority has obtained powers to extend the catchment areas at Dalgarrog, Caernarvon and Maentwrog, Merioneth, and intends to increase the plant at the former station by 10,000 kilowatts, while a scheme at Ffestiniog envisages a new hydro-electric plant of 35,500 kilowatts. The Severn tidal barrage is still in mind, although the main output capacity being at times off peak, an equivalent steam plant will be required. Research is still being carried out on wind-driven generating plant and sets are being erected by the North of Scotland Board in the Orkneys, and by the B.E.A. in Wales.

The wide variation in size of the 293 generating stations of the authority is exemplified by the difference between the largest at Hams Hall, Birmingham, of 570,500 kilowatts installed and some small hydro-electric or internal combustion driven stations in rural areas of less than 100 kilowatts.

Low Grade Fuel

Development continues in the direction of use of low grade fuel and it is of interest to note that one of the stations operating at a thermal efficiency of over 26 per cent. was operated on a fuel having a calorific value of a little over 9,000 B.Th.U. per lb. An even bolder experiment is the projected erection of two power stations in close proximity to colliery coal cleaning plant, adapted to operate on "washery rejects" or slurries.

The results of these experiments with high ash-content fuel will be watched with interest.

The load factor of the authority's plant in the current year stood at 46.9 per cent., slightly lower than that for 1951. Average generation cost per unit of electricity sent out rose from 0.4894d. in 1950-51 to 0.5296d. in the current year.

The fuel consumed by the authority amounted to 34.3 million tons of coal, of which 12.8 per cent. was opencast, 740,000 tons of coke, 70,000 tons of oil and other fuel, in all 35.11 million tons, 4.5 per cent. more than in 1951, while the electricity generated was 6.6 per cent. higher than in the previous year.

Although operating conditions of the grid were still difficult owing to the shortage of generating plant and interconnection facilities between main sections of the system, the larger amount of load spreading, improved weather conditions, improved supplies of domestic fuel and the reduction in the rate of increase of industrial demand for electricity resulted in fewer occasions of load shedding during the winter months than in the previous year. In the current year most of the load shedding took place during the summer months, whereas in the previous year this had occurred mainly during the winter.

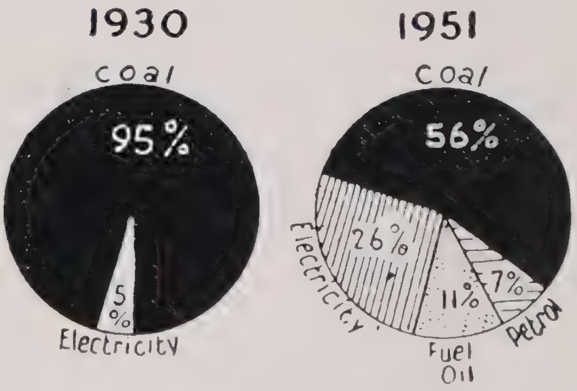
The grid is still unable in some respects to meet its requirements, and construction is still proceeding on the 132,000 volt section and also on the new 275,000 volt grid to extend ultimately from Glasgow to Tilbury. Investigations are proceeding as to the technical and economic aspects of a submarine connection between the electricity systems of Great Britain and France.

It will be of interest to all who have at heart the abolition of atmospheric pollution to learn that the scheme for heating the Pimlico estate by exhaust steam from two special turbines at the Battersea station is in operation and under examination as to its thermal and economic possibilities.

A disclosure, very remarkable to the uninitiated, is contained in the account of the measures to control the electric supply services during the period covering the two-minute silence on the occasion of the funeral of His Majesty King George VI on February 15th, 1952. It was impossible to predict the extent of the sudden fall in the load and consequent rise in frequency. The account of the measures taken, the reduction in frequency before the silence, the operating instructions given to steam power stations, the inter-connection with the hydro-electric system of the North of Scotland Board, to the variation in load amounting at times to 330,000 kilowatts per minute is illuminating.

In order to warn consumers of impending power cuts, arrangements have been made to inform the British Broadcasting Corporation, who would broadcast on the 1,500 meter wavelength in the Light programme appropriate load-shedding warnings, in addition to the general warnings issued in the news service at 7 a.m. and 8 a.m. The combined revenues of the authority and the area boards exceeded by £2,920,000 their total expenditure chargeable to revenue, making since vesting day, April 1st, 1948, a surplus of £20,800,000.

—*A.J.C.*



Fuel Changes in French Railways

A diagram from a recent article in the "Manchester Guardian," reproduced by kind permission, showing the remarkable reduction in the amount of coal, and increase in smokeless methods, on the French railway system

SMOKE PREVENTION ABSTRACTS

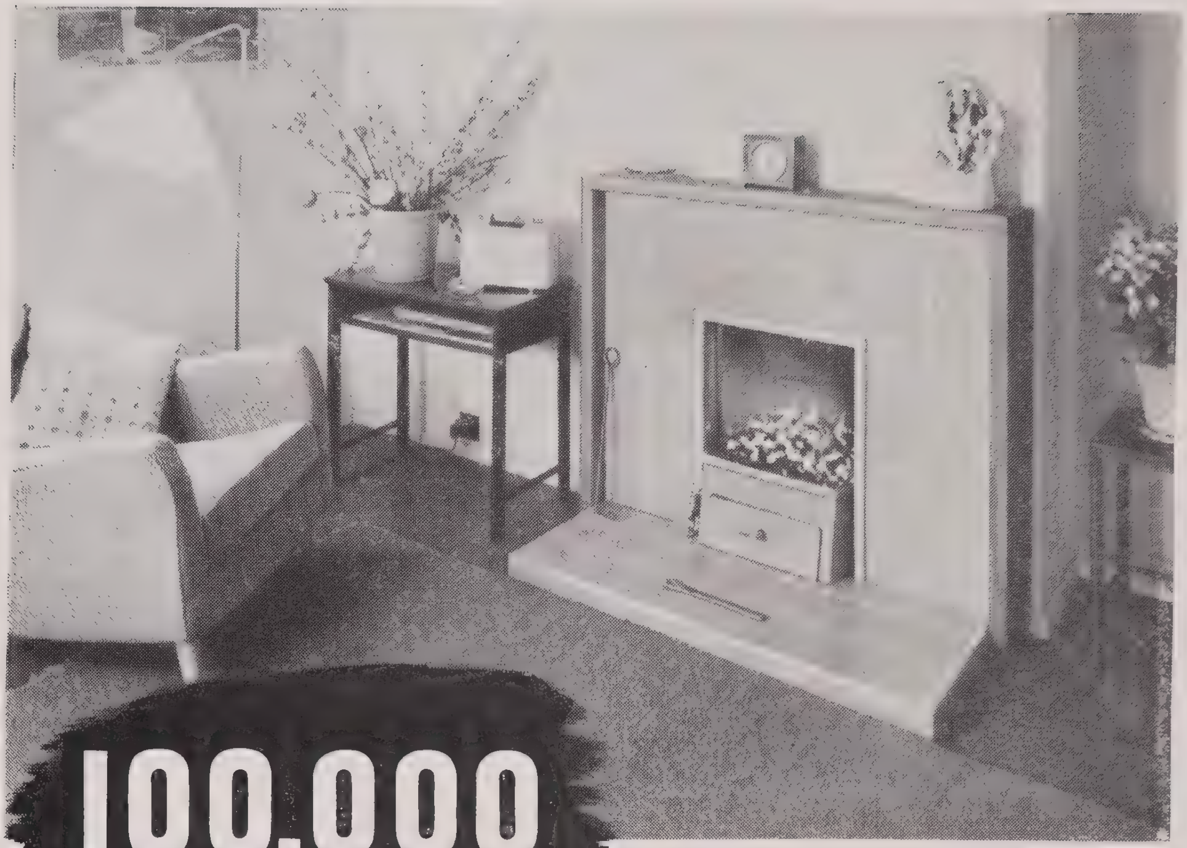
196. Ash and Atmospheric Pollution. Fitton, A. (J. Inst. Fuel, July, 1952, 178-181). This paper, read at the recent Ash and Clinker Conference of the Institute of Fuel, gives some indication of the source and magnitude of the pollution of the atmosphere by ash and its associated grits. Methods of measuring the concentration of fly-ash in flue gas and of determining the size of the particles are briefly outlined, and methods of reducing atmospheric pollution by means of plant design and control and by the use of dust-extraction equipment are surveyed. The size, nature and amount of ash which is emitted into the atmosphere can vary enormously, according to the type of coal, the type of combustion unit and whether or not a dust-extractor plant is fitted. Much is being done to reduce the emission of dust by using efficient steam-generating plant and by fitting efficient dust-extraction units, particularly in the modern electricity generating stations and the larger industrial plants.

196. B.S.I. Code for Domestic Heating Appliances (Codes of Practice, 403: 1952. Brit. Standards Inst. pubd. at 7s.). This code deals with the installation of open fires, heating stoves and cookers burning solid fuel. The section on design considerations includes recommendations on fire precautions relating to the construction of hearths and of walls above the hearth. Convector fires and non-convector fires, both with and without back boilers, are treated separately. The clauses on heating stoves deal principally with openable stoves and those on cookers with combination grates and freestanding cookers. An appendix gives guidance on the selection of the correct type and size of solid fuel appliances for a particular duty.

197. Efficiency of Domestic Solid Fuel Appliances, Shaw, W. F. B. (Paper read at Roy. San. Inst. meeting, London, 15 Oct., 1952). The measurement of the efficiency with which a domestic appliance burning solid fuel utilizes its fuel is not an easy matter. Moreover, many British types of appliance, notably the open fire, form an integral part of the structure of the house; the true efficiency is therefore not a simple function of the appliance itself, but is dependent both on the appliance and the structure in which it is installed. It is for this reason that the " test-bench " efficiency in the measurement of which the appliance itself is regarded as the dominant factor, usually represents an under-estimate of the true value of the appliance in the home. The functions and the limitations of the test-bench efficiency and its relation to " room-heating " efficiency, are demonstrated, using the case of the open fire as an example.

198. Means of Discharging Material containing Dust, with minimum of Air Pollution. Balfour, Beatty & Co. Ltd., and W. M. Alexander (B.P. 669, 927, 15th July, 1949). The discharge comprises a telescopic chute which, on extension, is sealed by engagement with a surface of the receptacle. Vacuum is applied to the chute to remove dust-laden air and water may be sprayed on the material. (Brit. Abst.).

199. New Sulphur Dioxide Detector (Chem. Age, 1st Nov., 1952). A new American device for detecting sulphur dioxide in the air and so preventing disasters such as at Donora, is reported. The device consists of a small glass tube filled with a vanadate-silica gel which changes from yellow to green or blue in the presence of SO_2, which it can detect in concentrations down to 5 p.p.m. Another gel which has also shown promise in tests has a periodate-silica base, turning from white to pink or red-brown. The depth of colour can be used to measure concentration of SO_2.



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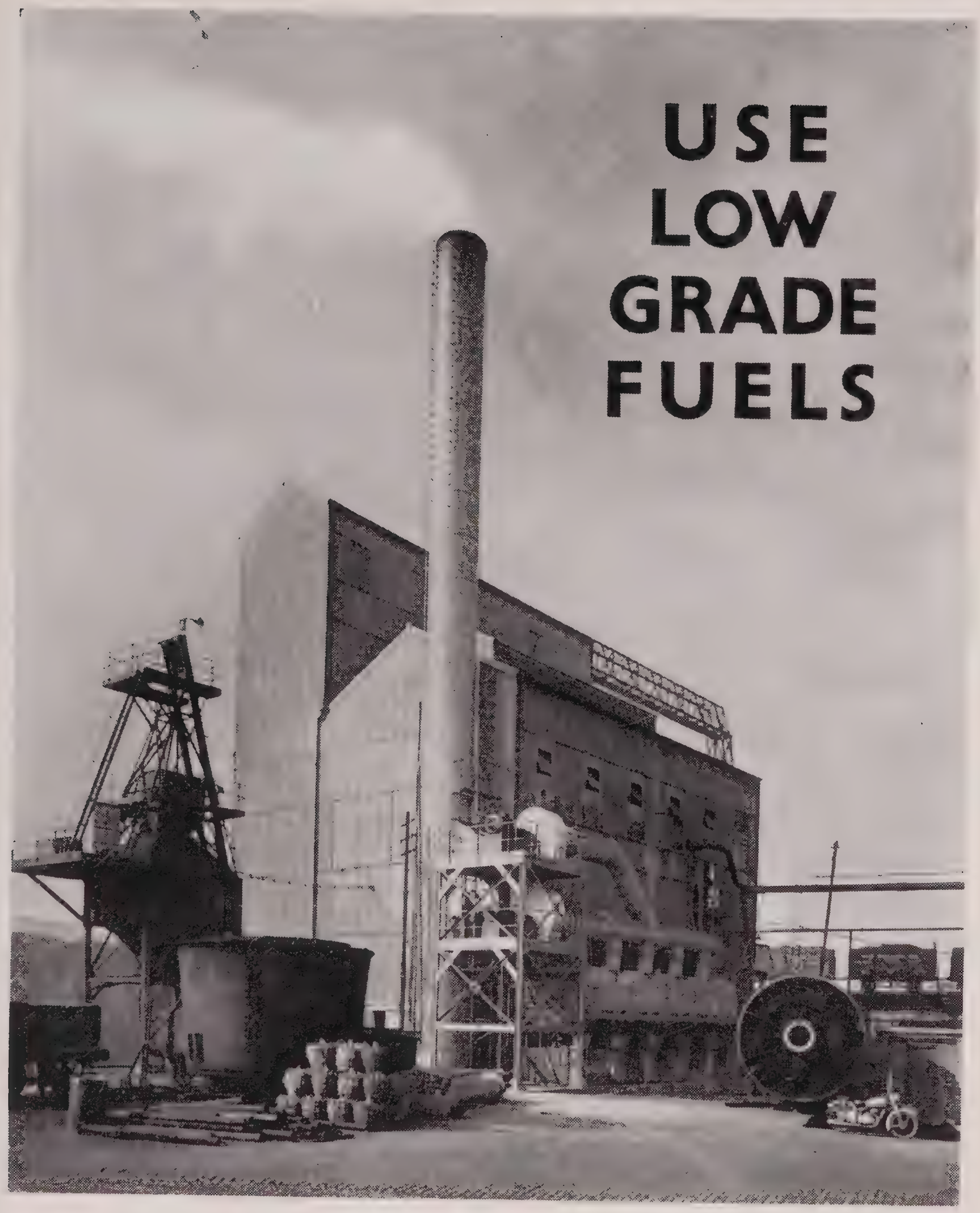

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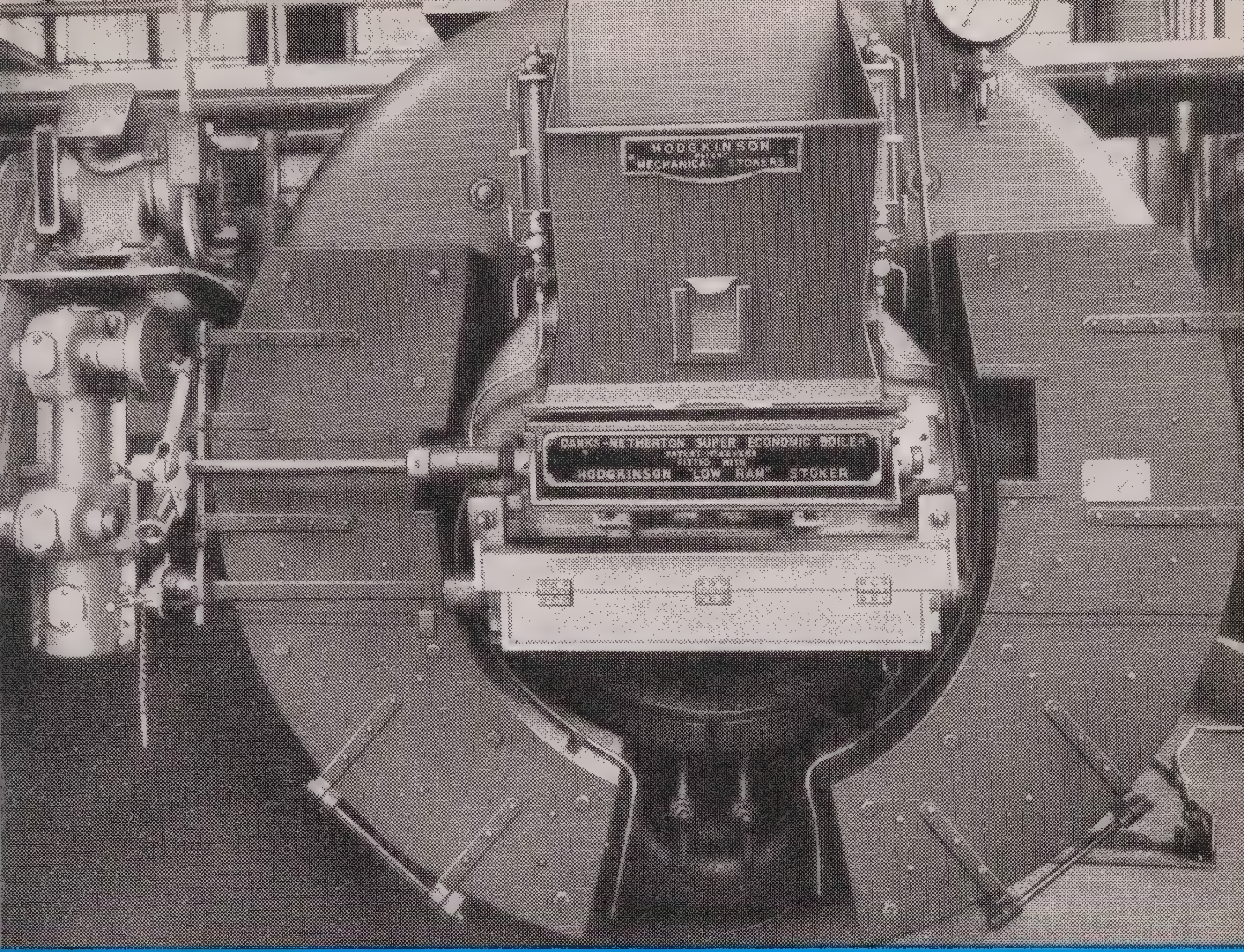
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SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL

No. 85 SPRING 1953

ONE SHILLING

In this Issue

THE LONDON FOG DISASTER

Questions in Parliament

American Industry and Smoke Prevention

Smoke Abatement and Fuel Economy in the Home

etc., etc.

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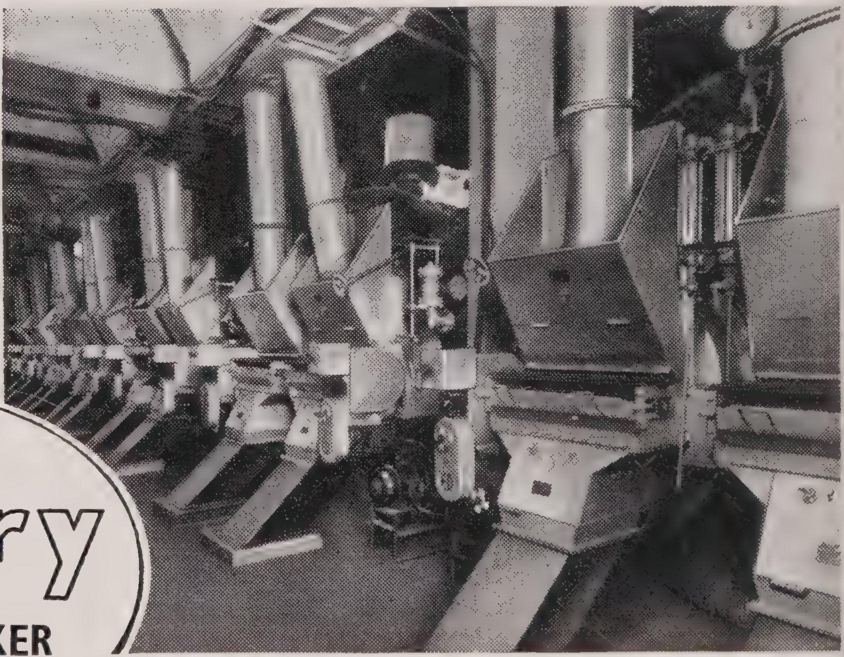

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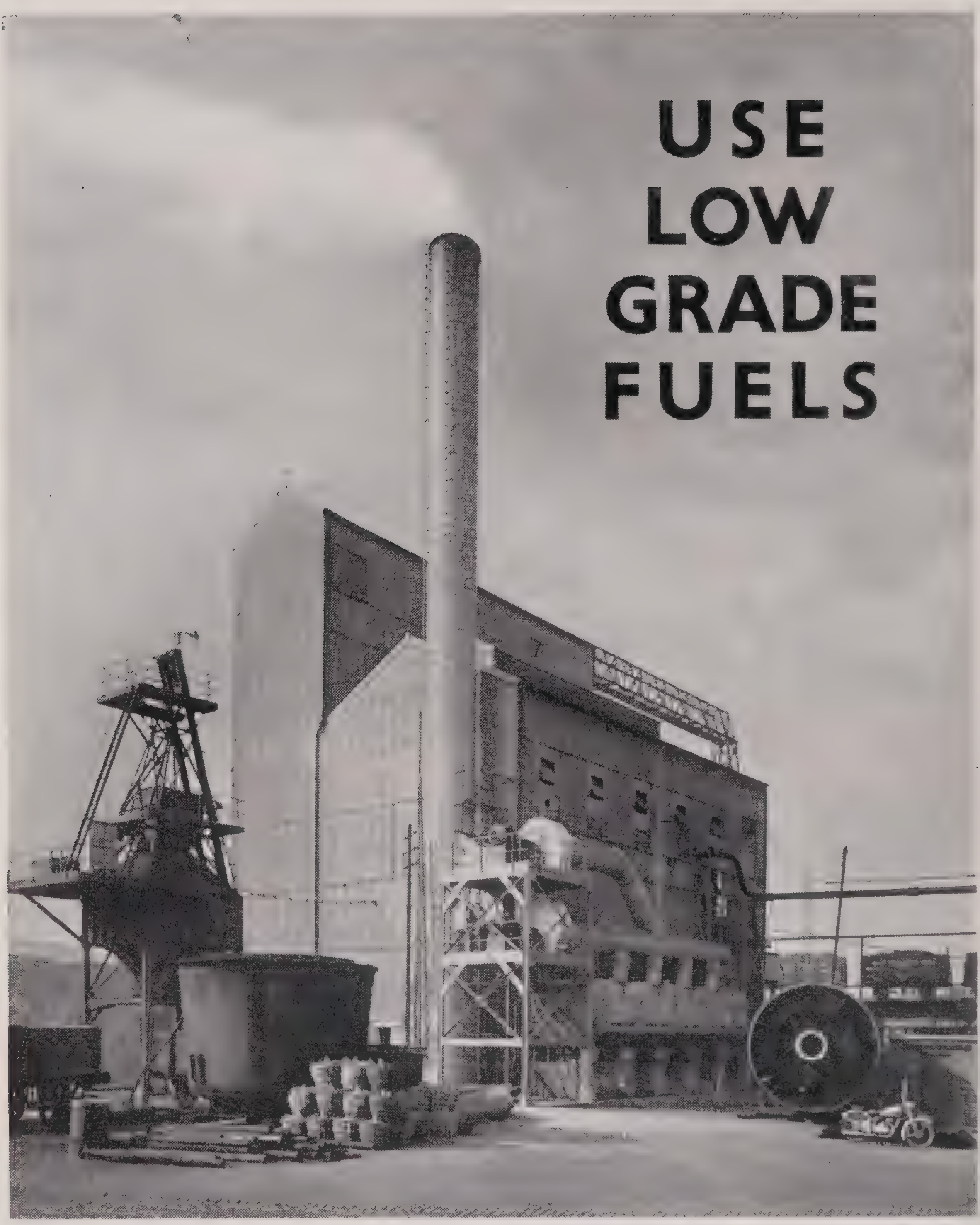

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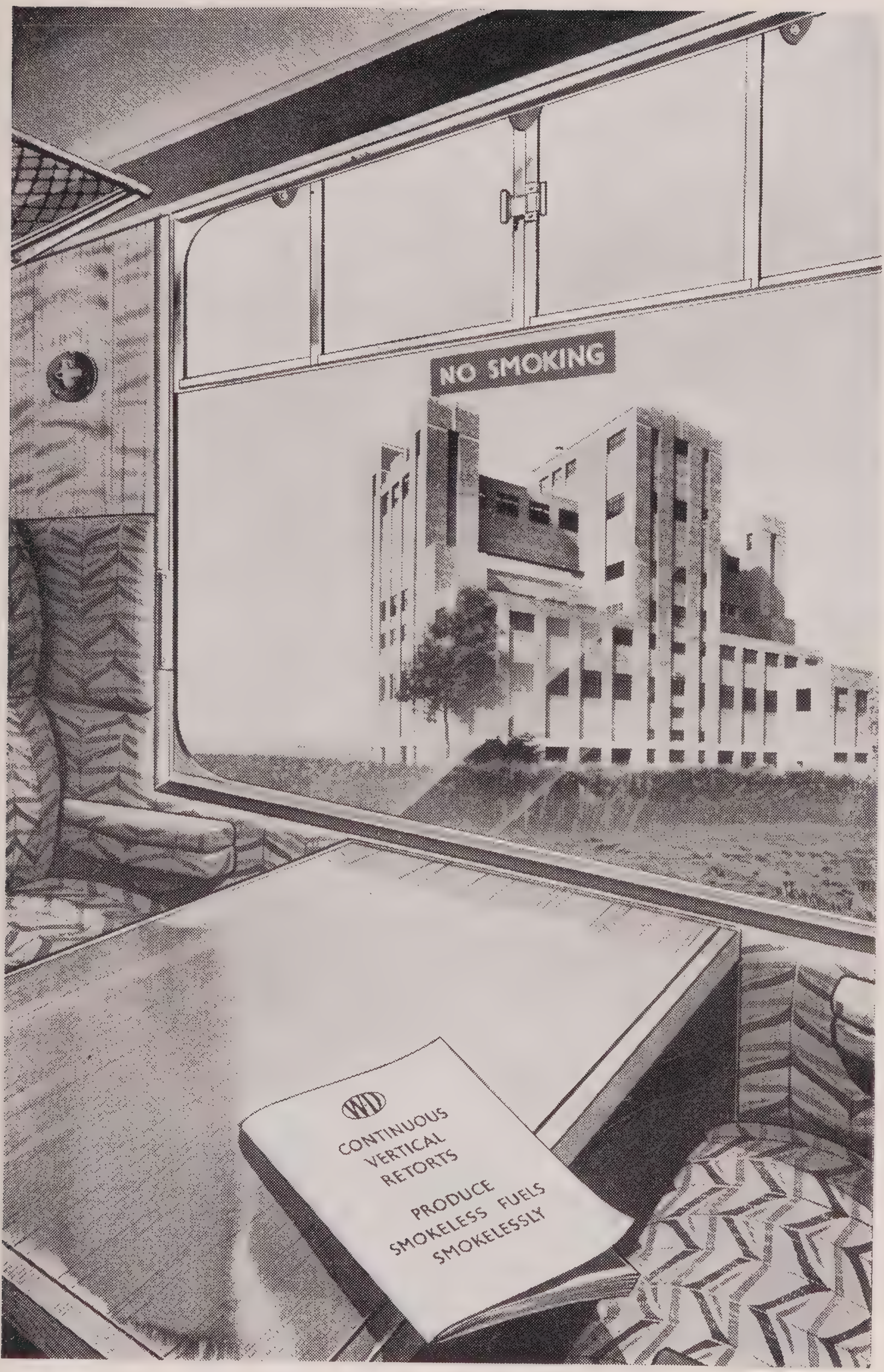
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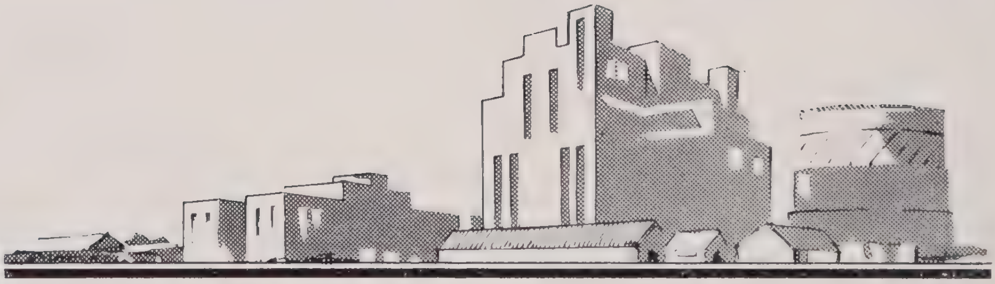

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SMOKELESS AIR

Vol. XXIII. No. 85 Spring, 1953

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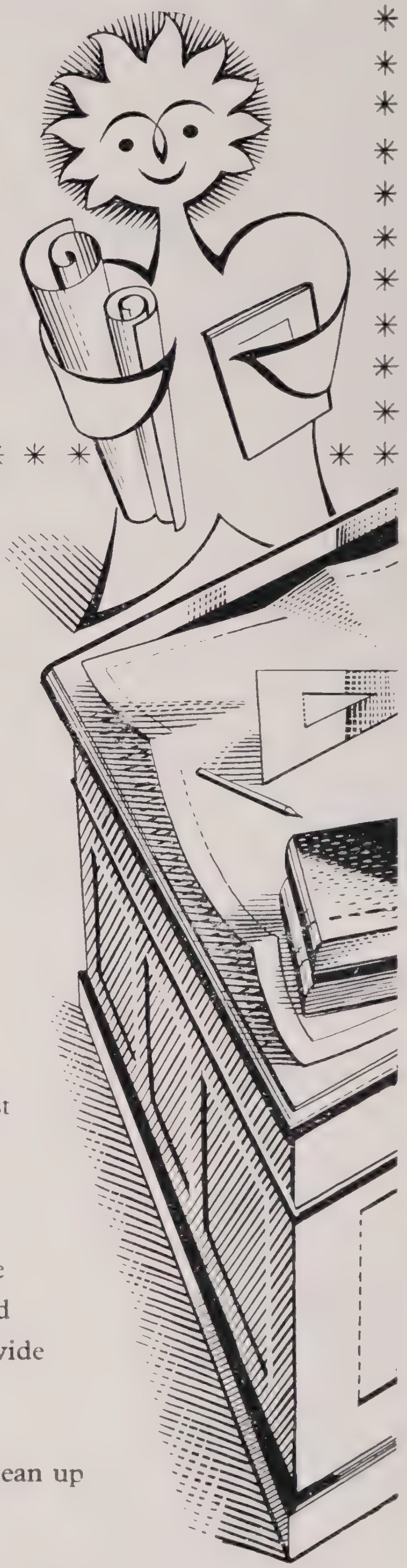
MR. THERM HAS A PLAN TO END THE FOG MENACE



Fog is a menace equal to the worst epidemic diseases. During the bad fog of the first week of December, last year, there was a greater jump in London's death rate than during the worst week of the terrible cholera epidemic of 1866. Fog's annual toll in death and disease, to say nothing of the heavy cost to trade and industry, makes action imperative.

Fog prevention begins with smoke prevention —and here Mr. Therm is ready to help. His twin fuels, gas and coke, never produce smoke or smut. But that doesn't prevent them from taking on the biggest—and smallest —assignments in industry and the home, and doing them efficiently and economically. New gas equipment is constantly taking its place in the latest industrial processes, while modern gas-ignited coke-burning open fires and stoves, with "background" heating by gas, provide the most satisfactory form of home heating.

Mr. Therm urges the use of gas and coke as a practical measure to end the fog menace and clean up the air of our cities.

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SMOKELESS AIR

LONDON ENSHROUDED

The opinions of the advocate tend always to be discounted, even if his case is proved. For this reason it is not easy to comment on the London fog disaster as strongly as we would like. One of the points we would wish to expand upon, for instance, has been admirably expressed by the journal *Weather*, which has no axe to grind. Its February editorial starts: " Thousands Die in Four-Day Disaster! We have not noticed this headline in our newspapers this winter, but it ought to have been there. . . . After the London affair it was reported that the number of deaths that week was nearly three *thousand* above the normal. What an outcry there would have been at such a deathroll from any other cause! And who were the casualties? Not necessarily those who would soon have died anyway. There are many of all ages who lead a happy and useful life, but who have bronchial tendencies, weak chests, and so forth; and those of normal health, whose throats become raw and whose eyes smart after a few hours of ' smog,' may easily guess its deadly effect on the more susceptible."

The reasons for the comparative unconcern, noticed by our contemporary and many others, about a disaster which, by the criterion of human life, was the greatest experienced in this country during time of peace for many years, would be well worth considering at length, but at the moment it will suffice to say that one of the most sinister features of smoke-fog is this very way in which it induces an attitude of apathetic acceptance. If, as with other plagues, it was followed by its own distinctive disease it would be very different, but when John Smith dies of bronchitis three days after the fog. . . . well, he *might* have died soon of bronchitis anyhow. It is the sum total of all the John Smiths that is significant, and it is to emphasize the grim statistics that we have recorded all the relevant figures in both tables and as diagrams in the survey on the fog that follows. No apology for so much detail about the fog is necessary: although others will no doubt discuss the aspects that are of interest to them—meteorological, medical, economic and technical—SMOKELESS AIR is likely to be the only journal to be concerned about the fog, its causes and its consequences, in their entirety.

The phrase "*comparative* unconcern" used above does not of course mean an absence of concern. On the contrary, there has been enough interest by the press and others especially during and immediately after the fateful days, almost to overwhelm the Society's headquarters office. It was on a scale we had not experienced before and very seriously put back all normal activities. There were news reports, special articles and editorials in many papers, and our press cuttings bundles have been greatly increased. But the fact remains that despite all this the disaster was not regarded, by public, press and Government as anything else of a comparable nature would have been. In part, at least, this is because there is not much of a "story" in John Smith's death from bronchitis. But it can be done. We wonder how many of our members were fortunate enough to read the moving and intensely "human" account of the Donora fog, by Bertram Roueché, that appeared in the *New Yorker* of September 30th, 1950?

So much for the public aspects of the case. Behind it all, however, and perhaps especially in the medical world, there are signs of a shock that may have far-reaching consequences. It is far too early to do more than record an impression, but in the future it may be seen that the London smoke-fog of December, 1952, was a climacteric in the long struggle for a cleaner atmosphere. This Society's course at least is clear.

Death in the Dark

Since these comments were written and just as they were being dispatched to the printer, the *Daily Express* published an outspoken leading article on the fog that is perhaps a first indication of the coming of a truer recognition of the catastrophe. It starts: "In this time of disaster there has been one disaster greater than all others put together. One shocking, frightening story whose most shocking frightening aspect is that its full implications have not yet been grasped by the British people. It is not the story of Lynmouth. Nor even that of the East Coast floods. It is the story of the death that came in darkness to 3,000 innocent, unsuspecting people . . . . murdered by the fog that for three days enveloped London."

And later: "Now the question must be asked: What is man doing to protect himself against the poison he himself creates? Are the people of London and the other cities of Britain to sit back and wait to be suffocated again? It seems as if indeed they must. True, the matter has been discussed in Parliament. True, the menace of smoke and sulphur fumes has been measured and assessed. True, the Smoke Abatement Society is doing its best to stir up official action. But how much sign is there of that action being taken? There is no sign at all. There has not even been a committee of inquiry established."

A Figure of Importance

A certain statistical confusion should be cleared up. It will be noted that the journals quoted above mention 3,000 as the number of deaths due to the fog, that in the Parliamentary discussion 6,000 was mentioned, and that Dr. Logan, Chief Medical Statistician of the General Register Office, gives 4,000. The 3,000 figure appears to refer only to London County; the 6,000 to greater London statistics compared with those of the previous year; and the 4,000 to the excess of deaths in Greater London (which includes the County) during the two weeks following the fog over the number anticipated from the general trend of the weeks immediately preceding the fog. 4,000 is demonstrably correct, and this is the figure that should be accepted as " official."

The Abbey and the People

Our customary frontispiece illustration of a smokeless air scene is for once replaced by a fine *Times* photograph of Westminster Abbey, a building which, above all our historical treasures, should be situated in clean air. The appeal for £1 million to restore it from the ravages of centuries of London's smoke and dirt, as the Prime Minister expressed it, is one that will be especially appreciated by members of the N.S.A.S., who are members because they want to see a halt called to such destruction.

Anthony Greenwood, M.P., in a letter to the *Times*, did well to draw attention to how the state of the Abbey underlines the urgent need to do more to end the conditions which mean the crumbling away of so many of our national monuments. No one would decry the need to put right the damage that has been done, but it is pertinent to plead also for more positive steps to prevent further destruction.

It is strange that our attention should be directed to the harm done by London's atmosphere to its great Abbey so soon after the tragic reminder of the harm done to its inhabitants. But the Abbey and the people are being attacked by the same evil. The Abbey is a great spiritual symbol in the life of the nation; cannot we let it also symbolize a new national determination to overcome the common foe?

Through a Glass Darkly

We recently heard a speaker, who should have known better, seek to belittle London's smoke deposit by saying that after all it worked out at only about an ounce to the square yard in a year. (It would of course have seemed even less if he had worked it out in grains per square inch!). A day or two later, after reading an editorial in the *Gardeners' Chronicle* on smoke and fog, we felt we would dearly like our speaker to go to the Lea Valley and tell the growers there that even if they had to clean their acres of glass from the deposits of London's fogs, at least there was only an ounce of it to the square yard. This is what the *Gardeners' Chronicle* said: " Ask a Lea Valley grower what he thinks of our particular brand of 'London Particular.' His remarks will be concise but usually unprintable. In such areas day assumes a half-light worse than night. The filthy mess coats the glass with a black, sticky deposit, seeps in through tightly closed ventilators and strikes down even plants which one would imagine too hard and leathery to be affected by anything less than a blow-lamp."

Other references to this article are made in the survey on the fog that follows on another page.

Smoke on T.V.

The television feature on the smoke menace, on January 2nd, created nation-wide attention, and by chance was well-timed in following so closely the London fog disaster. On the whole it was a well-constructed and imaginative programme, and good use was made of material that had been brought together and recorded in the Society's publications. The programme was initiated in Manchester, and that city was, in a way, the grim, unglamorous star of the show.

THE LONDON FOG

A First Survey of the December Disaster

THE word "disaster" in the headline has been used, after deliberation, as the only one adequate for its purpose. The American authorities called the fatal Donora fog of 1948 an "episode," but the very scale of that experienced by London brings it high into the category of disasters. A *British Medical Journal* annotation speaks of it as a "great disaster," and a writer in the *Lancet* as "a violent and untimely 'epidemic'" which "smote the people of London."

It may be months before inquiries being made are completed and all the evidence of importance obtained and assessed. We hope therefore to publish further reviews from time to time, and this first one must be regarded only as an interim report on what is likely to prove to be the gravest event in the history of air pollution.

In the *intensity* of its effects on human health it is probably exceeded by the Meuse Valley fog of 1930 and by that at Donora, but its *scale*, in terms of the population affected, was far in excess of either of these well-known cases. It can be compared, perhaps, only with the London fogs of 1873 and 1880, and may indeed, by some criteria, have been worse than those.

The Weather Factors

Between December 5th and 8th, 1952, an anticyclonic or high-pressure system of relatively cool air became established over the London basin, and was marked by an unusually prolonged period of almost complete calm. A temperature inversion, at a comparatively low height of from 200 to 500 feet, was set up. This means that the mass of cold, still air immediately above the ground was overlaid by warmer air, with a sharply defined deck or ceiling between the two layers. Natural water fog forming in such colder air is kept under the ceiling, and smoke is similarly trapped, sometimes even in the absence of natural fog. The absence of virtually all lateral air movement in this case prevented any marked drift, and consequent diffusion, of the fog, although a small amount of shifting from one day to another was noted.

The accompanying photograph, taken from the southern slope of Box Hill, and looking westwards, shows the top of the hill, and Ranmore Common (616 ft.) in the background, in bright sunshine, with the fog lying below. It clearly illustrates both the shallowness of the fog and the distinct line of the inversion ceiling.

A full and more technical description of the fog is given in an article by C. K. M. Douglas and Dr. K. A. Stewart in the March, 1953 issue of the *Meteorological Magazine* (H.M. Stationery Office, 2s.), and from this it is learned that on the 5th (Friday), the fog was mainly an urban (or smoke) fog. On the following three days, however, there was a dense rime-producing water fog, which extended to rural areas.

Although pollution may play no part, or only a minor part, in the production of a dense water fog it can add to its density and persistence. Douglas and Stewart in the article referred to above point out that by providing an abundance of nuclei for the formation of water droplets, the pollution probably caused the droplets of the London fog to be smaller, more numerous and more stable than those of the fog in the surrounding country. Temperatures were low during the period but by no means exceptionally so, and on the two coldest days the central London minima were 27° and

The Fog from Box Hill

28°F., with maxima of 32° and 33F°.

It was into the stable, shallow mass of fog-laden air that was poured four days' emissions from the chimneys of London and from the exhausts of its vehicles, producing a concentration of particulate and gaseous pollution that exceeded anything measured since observations first began.

The Pollution in the Fog

The concentration of pollution in the atmosphere during the fog is obviously a matter of the greatest importance, and it is regrettable that the number of local authorities co-operating by making the observations that are needed is so small that nothing like a complete picture of the situation can be hoped for.

The deposit gauges and sulphur dioxide recorders (lead peroxide instruments), which give monthly figures only, can provide little information of significance, and the number of instruments for the daily measurement of smoke and sulphur dioxide, by the volumetric method, number only six for the whole of the London area.

This method gives figures for the *average* daily amounts of smoke and of sulphur dioxide suspended in the atmosphere. Table I gives the figures for December 3rd to 11th at County Hall (from a report of the Medical Officer of Health, Dr. J. A. Scott, to the Public Health Committee). Smoke is expressed in milligrams of black suspended matter per cubic metre of air, and sulphur dioxide as parts per million by volume. The figures for December 7th and 8th, and 9th and 10th, are averages for the 48 hours. The figures are also shown in graph form in Figure 1.

TABLE I

Daily Smoke and Sulphur Dioxide Averages at County Hall

Day	Smoke (mg./cm.)	Sulphur Dioxide (p.p.m.)
Dec. 3	0.61	0.220
4	0.49	0.144
5	2.64	0.751
6	3.45	0.855
7	4.46	1.339
8	4.46	1.339
9	1.22	0.472
10	1.22	0.472
11	0.32	0.224

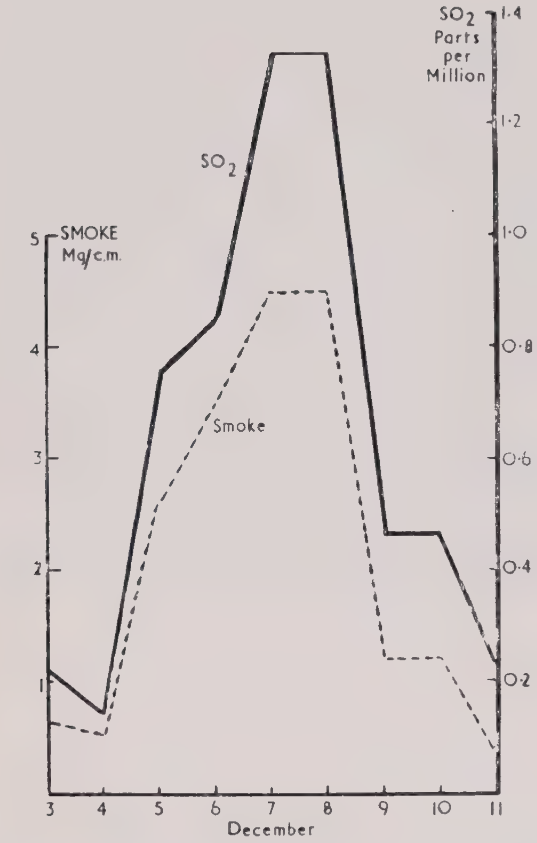

Fig. 1. Daily Smoke and Sulphur Dioxide Averages at County Hall, London

It will be seen that the highest average smoke concentration was 14 times greater than the lowest during the period; and that there was a ninefold variation in the sulphur dioxide figures. Bearing in mind that the figures are daily averages, and that for the peak days of the fog—during the week-end—they are 48 hour averages, it is likely that the maximum pollution reached was considerably higher than the average figure.

That this was indeed the case is suggested by some figures relating to the air filter plant at the National Gallery, Trafalgar Square. A communication received from the Information Branch of the Ministry of Works states:

> " The air conditioning plant has been operating on its present duties since mid-November, 1952. We have, as a normal routine check, recorded the filter resistance in a daily log-sheet.
>
> " From these records it would seem that in the course of 24 hours of fog the filters clogged at a rate of 26 times the normal, and in one period of four hours the rate was 54 times the normal."

The Deaths

The increased number of deaths that followed the fog is clearly shown in Table II below and in Figures 2 and 3, for both the administrative County of London and Greater London,* in which for comparison the weekly deaths for a number of previous weeks are also given. The extent to which the increase was due to pneumonia and bronchitis, and to diseases of the heart and circulatory system, is also shown in the case of the County of London, which is the only administrative area for which this information is given in the General Register weekly returns, from which all the figures in this section have been taken.

An increase in deaths from bronchitis, pneumonia, and heart failure following respiratory distress is of course common to severe smoke fogs (e.g., see Dr. W. P. D. Logan, SMOKELESS AIR, Spring, 1949, 42-43, on the London 1948 fog), and it is the abnormal extent of the rise that in this case is so remarkable.

As would be expected, most of the deaths occurred among the older people, but on this occasion, as Table III and Figure 4 show, all age groups were to some extent affected, with the exception of those between one and 24 years. From age 45 upwards the increase in deaths becomes very marked.

Dr. J. A. Scott, in the report previously mentioned, shows that although the death rate per million population during the week ended

---

* The Administrative County of London comprises the City of London and the Metropolitan Boroughs. Greater London is the area of the Metropolitan Police District, approximately 15 miles radius from Charing Cross, and includes the county area. Thus in the table the County figures are included in the Greater London figures.

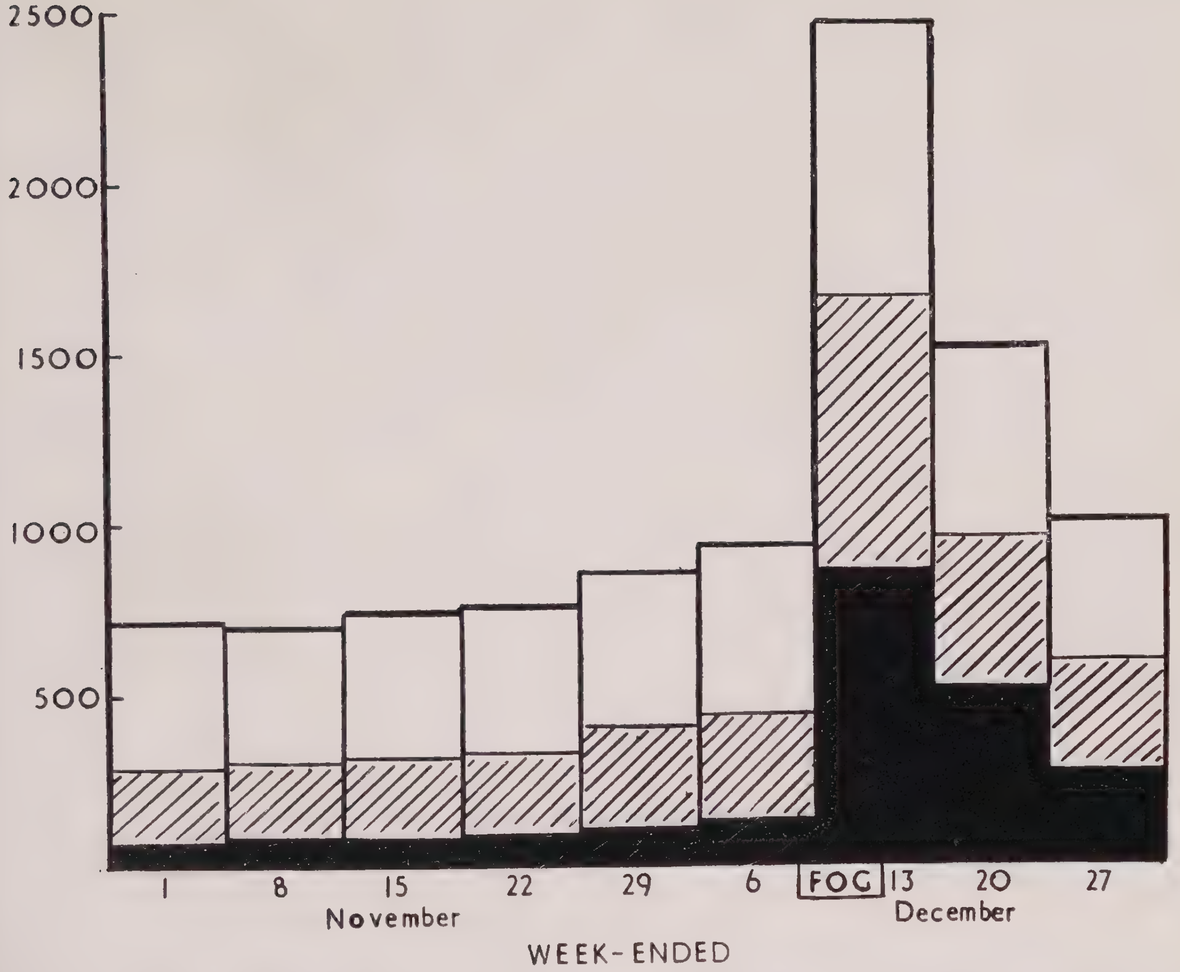

Fig. 2. Weekly Deaths, London (Administrative County). Black—bronchitis and pneumonia. Shaded—diseases of the heart and circulatory system. Unshaded—all other causes.

TABLE II

Deaths

Week Ended	*London*	*Admin.*	*County*	*Greater London*
	A	B	C	D
Nov. 1	67	223	714	1,511
8	74	226	693	1,593
15	74	247	747	1,565
22	77	264	753	1,699
29	101	312	853	1,902
Dec. 6	121	318	945	2,062
13	**872**	**801**	**2,484**	**4,703**
20	521	457	1,523	3,138
27	275	325	1,029	2,234

A=Bronchitis and Pneumonia.
B=Diseases of the Heart and Circulatory System.
C=All Causes.
D=All Causes (includes C).

TABLE III

Deaths by Age Groups
London Admin. County—All Causes

Age Group	*Average**	*Dec. 13th Week*
Under 4 weeks	17	28
4 weeks—1 year	9	26
1—4 years	7	7
5—14 ,,	4.5	6
15—24 ,,	7	7
25—34 ,,	13	28
35—44 ,,	28	64
45—54 ,,	73.5	204
55—64 ,,	132	448
65—74 ,,	213	717
75 and over	280	949

* Average of the six weeks Nov. 1st to Dec. 6th.

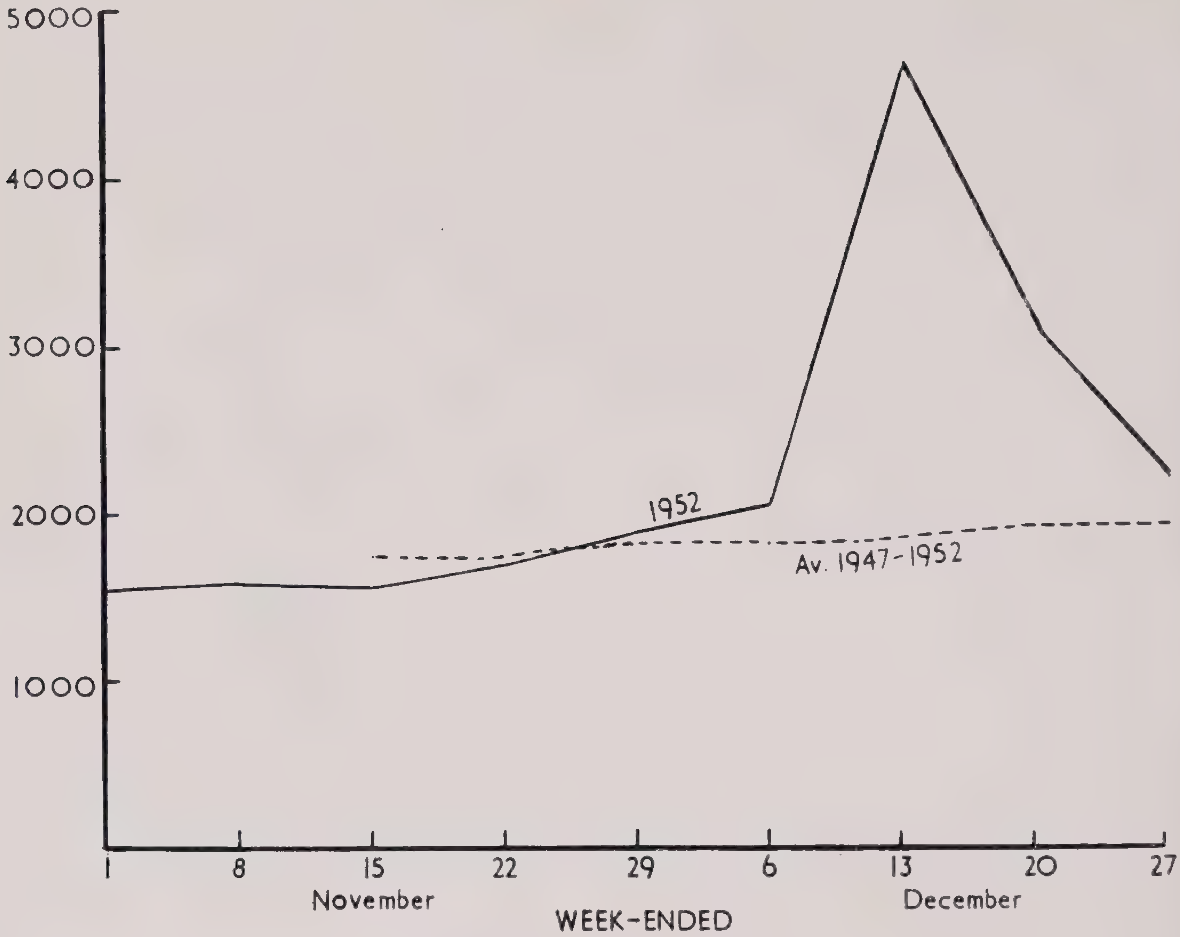

Fig. 3. Weekly Deaths, Greater London. (All Causes).

December 13th, 1952, was exceeded by weekly death rates in 1866, 1873 and 1918, the *excess* of the rate over the normal for the period and season was greater than 1952 only during the influenza epidemic of 1918, as shown in Table IV.

TABLE IV
Excess of Deaths, Administrative County of London

Year	*Excess of Deaths over normal (per million pop.)*
1866—cholera	426
1873—fog	243
1918—influenza	785
1952—fog	445

An interesting point to be gleaned from our all-too-brief records on the 1873 fog is that, in contrast to London's rise in deaths, that at Croydon, " outside the fog area," was only from 35 to 36. In 1952, however, deaths in Croydon rose from 74 to 150. Once more, however, outside the Greater London area, there seems to have been little or no rise in the number of deaths. In the eight " Great Towns " in the South East outside Greater London, the deaths in the fog week rose to 220 from 194 the week before.

The most important and most detailed analysis of the fog mortality yet to appear was published, as we go to press, in an article by Dr. W. P. D. Logan, Chief Medical Statistician, General Register Office, in the *Lancet* of February 14th (336-338). It may be possible to discuss this more fully in a subsequent review, but mention must be made of the attention the author draws to the rapidity with

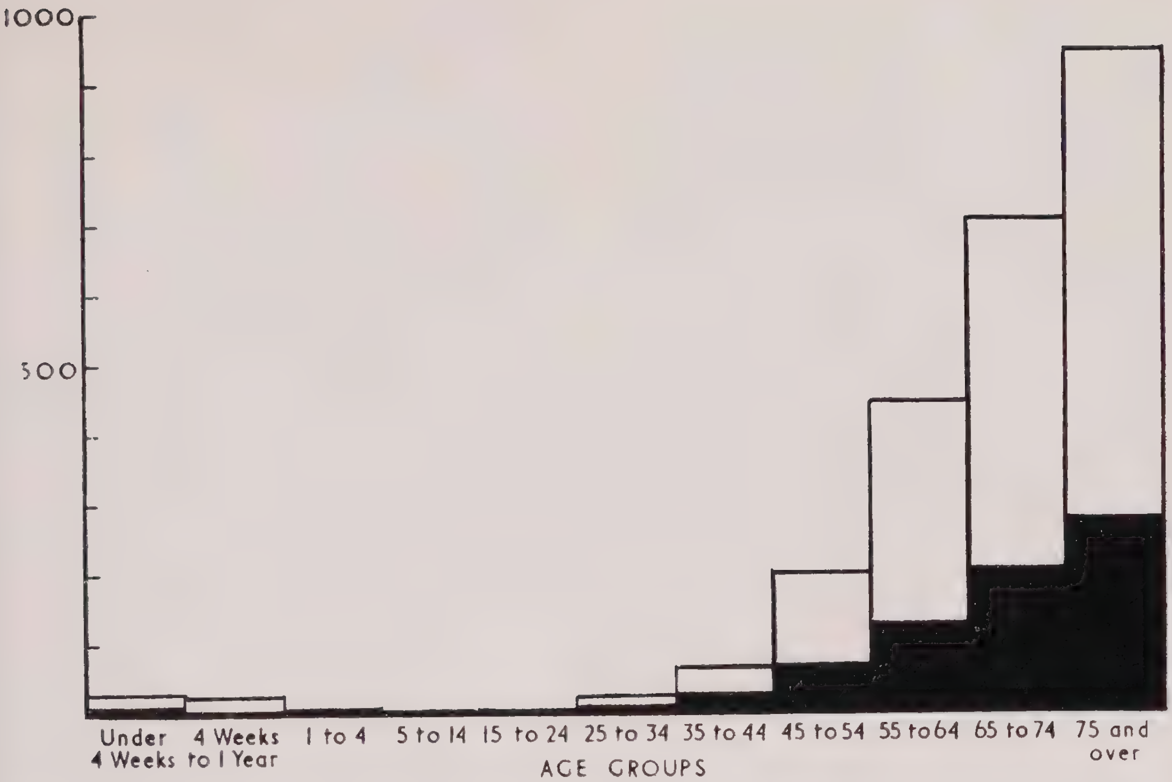

Fig. 4. Deaths by Age, London (Administrative County) for Week ended December 13th, 1952. (Black—average of the six preceding weeks).

which deaths started to increase. " Even on Dec. 5," he writes, " the first day of the fog, there was an obvious increase in the number of deaths, and the daily totals mounted rapidly to their highest levels on Dec. 7 and 8, the third and fourth days of the fog. There was some decline on Dec. 9, and a still greater decline on Dec. 10; but even on Dec. 15 the daily total was almost twice as high as before the fog began."

Also of great importance in Dr. Logan's article is a table showing the deaths, and their ratio to the preceding week, for the County of London, the outer ring of Greater London, by counties, and the 160 great towns of England and Wales. The highest ratio of increase was for London County (2.6), followed by the Essex part of Greater London (2.5), Herts. (2.1) Middlesex and Surrey (1.9) and Kent (1.7). For the great towns, minus Greater London the ratio was 1.04—an insignificant change. Similar ratios, deaths following fog to deaths in the previous week are given also for earlier London fog incidents, thus:

1873 ..	1.4
1880 ..	1.5
1892 ..	1.4
1948 ..	1.3
1952 ..	2.6

From this startling analysis Dr. Logan, who writes of the fog as " a catastrophe of the first magnitude," has every justification for concluding his authoritative article by saying:

" There is reason to believe that the fog incident in December, 1952, caused deaths in London on a scale possibly never experienced before from this cause. It is to be hoped that such an event will never recur—or be allowed to recur."

Illness

Death, being what it is, tends to overshadow the importance and significance of the illness, pain and distress that occurred, even though this must have been very many times greater than the number of cases in which the ending was fatal. At Donora, for example, nearly one-half of the population of 14,000 were more or less seriously affected by the fog, whereas only 20 people died. *If* anything like similar proportions of illness to death prevailed in London it would mean that the number of people affected would not be far short of a million. So far, there is no means of obtaining even a rough approximation, and it has been suggested that the only means of finding out is by means of a sample survey, on Gallup poll lines. Figures that give some lead are those for new claims of sickness under the National Insurance Acts, as given in Table V and Figure 5. The true effects are masked to some extent by the fact that the figures available are for Middlesex and London and thus include areas where the fog may not have had a serious effect, but exclude the parts of Greater London in other counties.

TABLE V

New Sickness Claims (National Insurance) London and Middlesex

Week Ended	*New Claims*
Nov. 11	15,100
18	15,000
25	17,100
Dec. 2	19,000
9	20,300
16	**28,900**
23	16,300
30	11,400

Also of significance were the applications for hospital beds, as reported in an article on the fog and the Emergency Bed Service, by Dr. G. F. Abercrombie (*Lancet*, Jan. 31st, 1953, 234-5). What happened is shown in Figure 6, reproduced by permission of the author and the *Lancet*. At the height of the influenza epidemic, on January 1st, 1951, 293 applications were received; at the height of the fog there were 492. The increase in sickness was mainly due to respiratory disease, which was nearly quadrupled, although heart disease also rose to about three times the normal numbers.

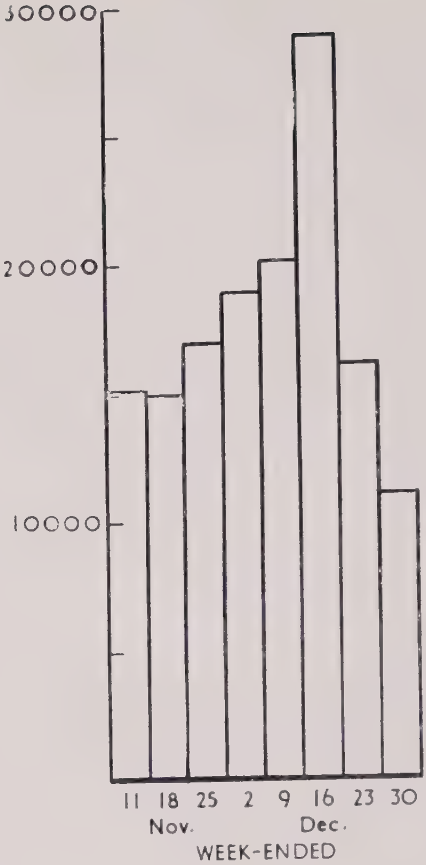

Fig. 5. New Sickness Claims (National Insurance) London and Middlesex

In the same issue of the *Lancet* an article on the effects of the fog on a general practice further illuminates the sickness position. In this practice, at Beckenham, the normal number of weekly visits for the time of the year is 75; during the week of the fog the number rose to 125. Attendances for respiratory disorders for the three weeks before the fog were 78; for the three weeks following the fog they were 206. Forty-three patients out of 4,500 in the practice were affected. Of these, 37 had a history of respiratory trouble. Sixteen of the 43 were severely ill, with considerable distress and some danger, and two died.

The London Ambulance Service experienced an abnormal number of calls. General illness calls for the six days, December 4th to 9th, compared with the same days of 1951, showed a rise in the number of calls of 71 per cent.—from 216 to 370.

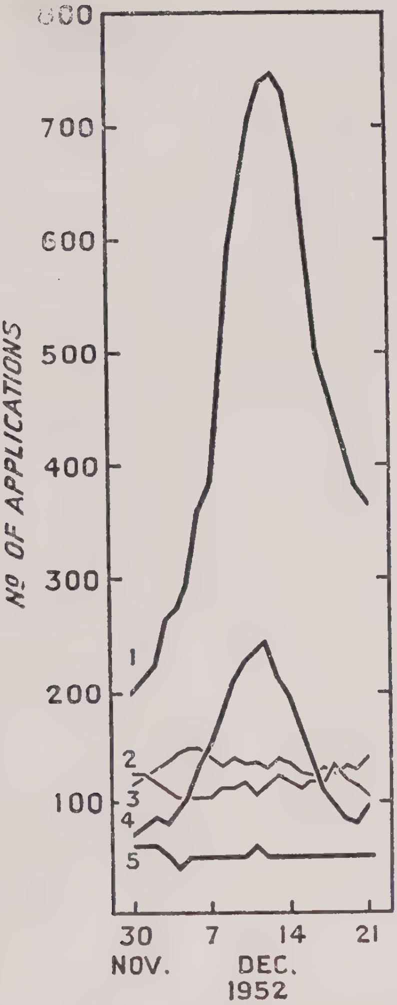

Fig. 6. Weekly totals of applications, London hospitals Emergency Bed Service, by types of disease. (1) Respiratory disorders. (4) Cardiac disorders, (3) Other acute medical disorders. (2) Acute surgical disorders. (5) Cerebral hæmorrhage

Animal Health

The death of cattle at the Smithfield Show during the great fog of 1873 has often been cited as an example of the bad old days of the " London Particular." That the same thing had happened again was the first warning of the nature of the 1952 fog, and was a clear indication of what the effects on human health would prove to be.

Mr. Basil O. E. Walpole, M.R.C.V.S., Veterinary Officer to the Smithfield Club, has kindly sent us the following communication on the subject:

> " It is of some interest to note that the sheep and pig exhibits escaped ill effects from the fog. This I attribute to the fact that these animals were on the first floor, where the atmosphere was much less contaminated as compared with that experienced on the ground level. Furthermore, sheep and pigs lay with their heads nearer to the floor, thus having the advantage of the straw acting as a filter.
>
> " The cattle which were exhibited on the ground level suffered considerable distress from the fog, some exhibits showing very severe symptoms.
>
> " Throughout the Saturday night and Sunday, 60 intravenous injections were administered to the most serious cases to combat the possibility of secondary invasion, and a further 100 cattle received appropriate treatment.
>
> " During the emergency five cattle died and nine cattle were slaughtered on Veterinary advice. On the Monday weather conditions improved and it was noticeable that the great majority of the cattle had a marked recovery.
>
> " The characteristic symptoms were those of marked respiratory distress accompanied by profuse salivation, with a typical rise of temperature.
>
> " Post-mortem examination revealed emphysema and commencing pneumonia, slight enteritis, with considerable fatty degeneration of the liver, kidneys and heart muscle."

Other inquiries made by the Society have shown that there was little noticeable effect upon animals at the Zoological Gardens, and that the effects on other animals, such as pets, were not such that any generalization could be drawn from them, although some increase in the numbers being treated at clinics was reported. Any further evidence on this aspect of the fog would be of interest.

Plant Life

The effects of smoke-fog on plant life in parks, gardens, allotments, farms, nurseries, and glasshouses are usually serious from an economic point of view, apart from aesthetic or

" Bapton Millie Actress," from Mr. J. V. Rank's Bapton Shorthorn Herd, being treated with oxygen at the Smithfield Club Show, Earl's Court, during the December fog.

amenity losses. Often however, by the time such effects become clearly evident, perhaps months later, it is difficult to determine precisely how much was in fact due to any one particular influence. The actuality of the effects of smoke-fog on plants can however, be gauged from the observations that can be made by experienced investigators in a specialized institution such as the Royal Botanic Gardens, Kew, and we are indebted to Sir Edward Salisbury, the Director of the Gardens for the following information, which in part is based on reports to him from the Assistant Curators in charge of the departments.

It is pointed out that most of the plants growing out of doors did not show any immediate unhealthy symptoms because they were dormant. " Evergreens were, however, coated with a thick greasy deposit of soot, and, as it is not likely to be washed off very readily with rain, it is evident that the growth of these plants is likely to be adversely affected during the coming summer, partly because the stomata will be clogged with soot, and partly because the intensity of the light reaching the chlorophyll will be materially reduced."

In the *Tropical Department* severe damage was sustained by a wide range of plants, the most common symptoms being loss of foliage and of flower buds or open flowers. Many of the orchids were adversely affected. Ferns showed no unhealthy symptoms, but many of the plants in the Palm House were severely defoliated. " One of the most remarkable facts was that the foliage of specimens of the Para rubber plant that were growing in a recently constructed and well-sealed quarantine house were damaged in spite of the additional protection afforded by the relatively fog-proof structure of the house. Cocoa plants in the same house were also adversely affected.

In the *Decorative Department* many fine displays of winter-flowering plants were completely spoiled. " It is well known that the buds and flowers of begonias are specially liable to be damaged in foggy weather, and that other ornamental plants such as the elegant blue-flowered *Coleus frederici* and the rose-coloured *Plumbago rosea* are very easily damaged. As was only to be expected these plants suffered even more severely than usual during the recent fog. Then again the varieties of *Coleus blumei*, known respectively as ' Sunset ' and ' Golden Ball,' lost most of their foliage and the stems subsequently decayed. The Kew stock of these plants was largely destroyed." Many other plants were injured, but Camellias and Chrysanthemums were not adversely affected.

Camellias also sustained little damage in the *Temperate House*. Here the foliage was scorched and fell from Fuchsias, Begonias and from species of *Cestrum*, *Luculia* and *Sparmannia*. A number of species were so adversely affected that they were eventually killed outright, including species of *Echium*, *Lotus bertholletii* and young plants of *Drimys colorata*.

" It is a well known fact," concludes Sir Edward Salisbury's note, " that greenhouse plants are less severely damaged by a town fog if the temperature is kept low and the atmosphere dry. This has been confirmed repeatedly in all the departments in the gardens at Kew, as well as by controlled experiments made at the Jodrell Laboratory shortly before 1939."

The Gardeners' Chronicle (January 31st, 1953) had an outspoken article on " the modern menace " of smoke and fog. Looking at the question mainly from the point of view of the commercial grower, the article mentioned the damage done to the foliage of Chrysanthemums—ready for the Christmas trade—and to ornamental Winter Cherry, *Solanum capsicastrum*, and to *codiaeums*. " Many other greenhouse subjects were doubtless affected to a greater or lesser degree, and the total harm done is beyond estimate. Add to this the cost of cleaning many acres of blackened glass and we have a fair picture of the menace of a modern industrial fog on the horticultural industry."

The Economic Costs

The material cost of fog to the community consists of direct expenditure, damage or loss sustained, resulting in a loss of value even when no expenditure follows, and the value of lost production. It is difficult to obtain even the roundest of figures on what a little reflection shows must be a very large total, and difficult also to separate the cost due to natural fog (e.g., traffic delays in country areas), due to the combination of fog and pollution, and due wholly to the pollution content. Estimates attempted in the past suggested a figure in the region of £1,000,000 a day for a large city, which means that at present day prices a four-day fog of the nature of that being considered must have cost London at least £10,000,000 in expenses, depreciation and lost time.

In the hope of being able to obtain some definite facts and figures an inquiry was made, immediately after the fog, to about twenty-five of the larger department stores and multiple shops in London. The Society does not possess the staff that would have been required to conduct the much more extensive investigation that might have been undertaken, and it was considered that the section of the retail trade approached was the most promising line of inquiry.

The replies received from three stores and shops to our questions have been exceptionally interesting, both for the information they contain and the information they show is unobtainable. In the first place it is very clear that the fog was recognized as a most serious matter, especially as it occurred during the Christmas shopping season. The item of loss most easily seen, and obviously causing greatest concern, is the loss of trade. One firm of multiple shops estimated that its turnover was down by 34 per cent. compared with the previous year. Another firm puts its loss at £2,000, and another at £11,000, while still another gives £9,000 as the loss of gross profit. " Trade once missed," says one department store, " does not on the whole come back later." On the other hand, a multiple shop firm thought that it would, but that then the congestion and pressure of work thus caused would be an inconvenience of some magnitude to the staff. On the basis of their own losses one store estimated that the cost of such a fog to a retail firm would be of the order of five shillings in each £100 of annual gross profit.

Damage and soiling of stock was evidently general, though few figures could be given. One store has however gone fairly closely into the matter and has estimated a loss of stock to the value of £1,000. Two shops mention £50 as a probable figure. Typical comments were: " Considerable damage to millinery, linens and garments of a light shade "; " very serious loss due to soiling of delicate fabrics "; and " damage over soiling of stocks has been very considerable as even if a new article becomes slightly soiled it has to be withdrawn from stock or put on sale at a very much reduced price." One firm reports that the fabrics mainly affected were nylon in the piece and made up as garments, but as they were readily washable there was no real damage. Another mentions nylon and terylene fabrics as being badly affected.

Most of the firms were unable to assess the cost of extra cleaning of their premises as a result of the fog, often perhaps for the reason expressed by one big store:

> " It is impossible also to estimate the cost of additional cleaning and maintenance since it does not cause us to vary our time of cleaning. It will merely mean that the building looks more unpleasant until regular cleaning has caught up with the ravages of the fog."

Another says: " Grime deposited on the building, fixtures and fittings naturally entails intensive cleaning, thus incurring additional cleaning and maintenance costs." A third says: " Considerable expense was also incurred through the necessity of employing special squads of cleaners." Another statement is that "Additional cleaning was essential, particularly in the restaurant, where the window curtains had to be laundered immediately the fog cleared, and in the windows, and it is probable that light-coloured articles displayed in the windows and throughout the store which were soiled by the fog particles will consequently have to be reduced in price."

A comment with an additional point of interest is:

> " Dresses were also badly affected and mark-downs will be very considerable. Merchandise in windows was damaged as the fog went through ventilators, and carpets in the windows were badly soiled. Also the exterior of our building, which had been cleaned a few weeks ago for the Coronation, has lost its freshness."

Finally, among miscellaneous items of cost mentioned, were loss of staff time due to late arrivals and sending young members of the staff home early, the extra cost of sick pay, the cost of overtime for van drivers, and three mentions of burglary in the fog.

We are grateful for this information and for the appreciation of our inquiry that was shown by nearly all the firms approached. One or two, but only one or two, seemed to feel that fog, even such a smoke-fog as this, was just part of the weather and had to be accepted as such.

Although this very limited inquiry provides little in the way of statistical ammunition about the cost of fog, or of smoke generally, it does help to confirm the convictions of those who have studied the question that there is a vast, but widely-spread and large unperceived overhead charge—what has been called the smoke tax—that is borne by all trade, industry and administration.

32 YEARS AGO

"Statistical evidence shows a close relation between the death rate and the atmospheric conditions; the number of deaths from pulmonary and cardiac disease is shown to increase in direct proportion to an increase in the intensity and duration of smoke fogs. The cause underlying the high mortality in towns, which is known to follow in the wake of a fog must operate continuously, though in a lesser degree, on the health of an urban community."—*Report of the Departmental Committee on Smoke and Noxious Vapours Abatement*, 1921.

Questions in Parliament

22nd January, 1953

Lieut.-Colonel Lipton asked the Minister of Health what representation his Department has on the Atmosphere Pollution Research Committee; and whether he has yet notified the Committee that 4,703 persons died in the Greater London area during the week ending 13th December, 1952, as compared with 1,852 during the corresponding week of 1951, a large part of which increase he has attributed to the fog.

Mr. Iain Macleod: My Department is not represented on the Committee, but I have confirmed that the Committee are aware of the figures quoted by the hon. and gallant Member.

Lieut.-Colonel Lipton: While thanking the right hon. Gentleman for that reply, may I ask him whether, as the fog in December, with its man-made atmospheric filth, killed thousands of people in the London area, he will see, as a matter of urgent priority, that his Department is represented on this committee and will take the most vigorous steps, in association with the Departments concerned, to reduce this appalling and unnecessary loss of life, which in the light of the figures that he has mentioned—6,000 more deaths in five weeks in London—is on the scale of mass extermination?

Mr. Macleod: My Department has been looking into this matter as a problem of the very greatest urgency, as I agree it is, but this committee is mainly a scientific body concerned with causes, whereas, for obvious reasons, I am far more concerned with effects. I think that the method that we are adopting—there is a link between this committee and the M.R.C.—is a better one.

Sir Edward Keeling: Is my right hon. Friend aware that in Westminster alone deaths from heart diseases were more than doubled in those days of fog, and that deaths due to lung conditions were nearly five times as great?

Mr. Noel-Baker: Will the Minister give consideration to the granting of a subsidy to the Smoke Abatement Society?

Mr. Macleod: I will look into that suggestion. It does not really arise on this answer.

Mr. Hastings: In giving continued consideration to this matter, will the Minister also note that there is some evidence that the smoke and fumes of cities predispose to cancer of the lung

27th January, 1953

Mr. Dodds asked the Minister of Housing and Local Government the last occasion on which an inter-Departmental committee inquired into the cause and effects of fog; and what action has since been taken to combat the worst features of this type of weather.

Mr. H. Macmillan: This is an important problem. So far as I know, no inter-Departmental committee has investigated the weather conditions which cause fog; I believe they are generally well understood. As regards the prevention of atmospheric pollution, I would refer the hon. Member to the reply the Parliamentary Secretary gave him on 18th December.

Mr. Dodds: Does the Minister not appreciate that last month, in Greater London alone, there were literally more people choked to death by air pollution than were killed on the roads in the whole country in 1952? Why is a public inquiry not being held, seeing that inquiries are held into air and rail disasters which do not affect so many people? Is consideration being given or will it be given to initiating a much more thorough investigation, on the lines of that conducted by the American Government in 1948? Has the right hon. Gentleman seen the report? It begins with:

> "The whole nation was shocked when 20 people died as the result of fog in the last week in October, 1948, in the town of Donora, Pennsylvania."

Mr. Janner asked the Minister of Housing and Local Government how many local authorities have sought and obtained special powers, since the war, to deal with the pollution of air by smoke in their areas; to what extent the operation of such powers has proved effective; and whether he will consider the introduction of general legislation dealing with the subject.

Mr. H. Macmillan: Twenty-seven local authorities have sought and obtained special smoke abatement powers since 1945; in addition, two county councils have obtained powers for the use of district councils in their areas. The effects of these powers, as distinct from those available under the general law, cannot be readily assessed, and I am not satisfied that further general legislation is needed at present. I am, however, keeping this aspect of the matter in mind.

Mr. Janner: But is not the Minister aware of the fact that disastrous results are following on these powers not being exercised, and is he not prepared to do something further to urge local authorities to attempt to exercise the powers vested in them?

Mr. Macmillan: We do what we can but, of course, the hon. Gentlemen must realize the enormous number of broad economic considerations which have to be taken into account and which it would be foolish altogether to disregard.

Mr. Noel-Baker: Will the Minister take into account the great economic waste that results from the bad use of fuel, and will he use all his powers to persuade the Government to carry out the recommendations of the Ridley Committee to avoid that waste?

Mr. Macmillan: We are doing that to a great extent in our new building, but it is a big undertaking to alter the whole of the present fuel system of the country.

Mr. Gibson: Is the Minister aware that this is also a very serious human problem and that during the fog period in December the death rate in London was the highest it has been for a comparable period for over 50 years? Surely some step must be taken to implement the Ridley Report or some other proposals in order to avoid fog trouble in large cities?

Mr. Blenkinsop: Can the right hon. Gentleman at least encourage local authorities in the development of a smokeless zone, which seems the most profitable way of tackling this problem?

Mr. Macmillan: The hon. Gentleman knows perfectly well that there are dual problems of the right kind of fuel and apparatus in which to burn it, and to think that we could suddenly change the whole country in the twinkling of an eye from one system to another is ridiculous. On the other hand, we are making steady progress in the use of new designs and methods and in making them, if not universal, at any rate almost universal, in the new houses and in other ways. I think we can say that we have made as much, if not greater, progress in the last year as has been made at any other time.

Lieut.-Colonel Lipton asked the Minister of Housing and Local Government what representation his Department has on the Atmospheric Pollution Research Committee; or in what other ways he co-operates in the work of this Committee.

Mr. H. Macmillan: My Department is represented on this Committee by the Chief Inspector of Alkali Works.

Lieut.-Colonal Lipton: What is this Chief Inspector doing as a result of the 6,000 deaths that took place in the Greater London area in December as a result of the fog? Is the Minister aware that his complacency in dealing with this problem is creating a lot of dismay, and is he further aware that the increasing use of modern domestic fires, which burn all night—[Hon. Members: "Speech."]—using such smoky fuels as nutty slack, is adding to the number of—[Hon. Members: "Speech."] Mr. Speaker, may I have your protection?

Mr. Speaker: I do not think that the hon. and gallant Member is generally in need of my protection, but I think he would make his supplementary question more easily audible and less interrupted if it was shorter.

Lieut.-Colonel Lipton: Is the Minister aware that the increased use of these modern appliances, which burn all night, using fuels like nutty slack, have during his tenure of office added another 250,000 fog-producing and air-polluting flues in this country? What is he doing about this?

16*th February*, 1953

Mr. Nabarro asked the Minister of Fuel and Power whether his attention has been directed to the report of a sub-committee of the National Smoke Abatement Society on nutty slack, reported recently in the journal *Smokeless Air*, a copy of which has been sent to him; how far his researches have established that smoke emission from this slack, burned in open domestic grates, is greater than any other type of coal, with aggravation of smoke-fog during winter months; and whether he will now consider alternative applications for nutty slack and the release to householders of more suitable solid fuel, misapplied in other directions.

Mr. Geoffrey Lloyd: Yes, Sir, and the report recognises the reasons for the sale of this small coal, which are to eke out the limited supplies of large coal by burning the two sorts mixed together. The report indeed says that smoke can be reduced in this way, and I agree.

Mr. Nabarro: Is my right hon. Friend aware that much good quality large coal is being misapplied in other directions? Is it not possible, for instance, for some of the three million tons of large coal burned under power-house boilers last year to be diverted to the domestic consumer, and an equivalent quantity of nutty slack, slurry and low-grade coal sent to the power-houses, which boast that they can burn coal of that quality quite efficiently?

Mr. Lloyd: Every effort is made to examine most carefully any large coal allocated for industrial purposes, and to get it reduced wherever possible. Of course, economies in power houses do largely free this untreated small coal which we are discussing.

Lieut.-Colonel Lipton: Has the right hon. Gentleman caused any inquiries to be made into the extent to which the use of nutty slack contributed to the fog in London last December, as a result of which 6,000 people lost their lives and 25,000 more sickness benefits were claimed under the National Insurance Scheme during that period?

Mr. Lloyd: I think that is an interesting point. This particular coal has needlessly got a bad reputation in regard to that particular fog. The advertising campaign of this coal by the Coal Board had just started, and was, so to speak, in full operation, but an infinitesimal supply of nutty slack had been delivered in London at that time.

Lieut.-Colonel Lipton asked the Minister of Fuel and Power how much nutty slack has now been purchased by domestic and other consumers.

Mr. Geoffrey Lloyd: About 200,000 tons so far.

Lieut.-Colonel Lipton: Does the right hon. Gentleman still maintain that the use of nutty slack, which seems to produce smoke without fire, is having no effect whatsoever on the pollution of the air over our great towns and cities?

Mr. Lloyd: Of course, it is the fact that coal, even good coal, produces smoke, and it is a matter of degree, but it also produces warmth which is very much required at the present time.

Mr. P. Roberts: Is my right hon. Friend aware that nutty slack can be used in some modern grates with very great advantage to the consumer?

Mr. Lloyd: There is absolutely no doubt about that. It should be mixed, and it was always insisted by the Coal Board that it should be mixed, with ordinary coal, making a very useful addition to the supplies of fuel.

Mr. Hamilton: Can the Minister indicate to what extent deliveries of nutty slack are holding up deliveries of better quality coal?

Mr. Lloyd: I do not think they are holding up supplies of better quality coal, but I think it is important that people should realise at the present time that they can help themselves and the country by using nutty slack and coke mixed in with ordinary coal.

A new fortnightly publication, *Fuel Economist*, is drawn to the attention of our members. Priced one shilling, it is published by Arrow Press Ltd., 157 Hagden Lane, Watford, Herts. The Editorial Director is Dr. W. F. Coxon, M.SC., F.R.I.C., M.INST.F. Its interests cover all fields of fuel efficiency—coal, coke, gas, electricity, processed fuel, oil and insulation.

Smoke and noise were Sydney's twin evils, said the Metropolitan Medical Officer of Health, Dr. Grahame Drew speaking at the annual conference of New South Wales Health Inspectors recently.

Obituary

Miss Marion FitzGerald

Miss Marion FitzGerald, who died at Cheltenham in January was also one of the small band of people who brought the Society into being and nursed it into success, and it is a sad coincidence that we should have to record together the deaths of two of our first committee members. Miss FitzGerald was well known as a social worker, especially in the field of housing, and carried out a number of important investigations, such as the special survey she made for the Ecclesiastical Commissioners on their London property. After being a Sanitary Inspector at Woolwich she came to Manchester about thirty years ago as private secretary to Mr. E. D. Simon (now Lord Simon of Wythenshawe), and was joint author with him of the book *Smokeless City*. (1922). For a time she was joint Hon. Secretary of the Society's Manchester and District Branch (now the North West Division).

Her last main work for the Society was to begin an inquiry into the costs of smoke, with the assistance of the British Commercial Gas Association. This inquiry was begun in 1939 and was developing on lines that showed excellent promise—some of the figures obtained are still widely quoted—when it was abruptly cut short by the outbreak of the war.

If Miss FitzGerald was an enthusiast she was an unusually well-informed and intelligent one. She was friendly, charming, and rather quiet and gentle in her manner, but clear and definite in her judgments. Although her health broke down some months ago her interest in the Society continued, as was shown by a characteristically encouraging letter written only a short time before her death.

Dr. R. Veitch Clark

We regret to record the death, at Galashiels, on January 20th, at the age of 76, of Dr. R. Veitch Clark, M.D., CH.B., D.P.H. He was Medical Officer of Croydon from 1913 to 1922, when he was appointed as Medical Officer for Manchester, a post he occupied with great distinction until his retirement in 1942. Even then, however, he continued to work as a senior hospital officer of the Ministry of Health.

The smoke abatement movement owes a debt of gratitude to Dr. Veitch Clark. He was Hon. Secretary of the Manchester and District Regional Smoke Abatement Committee and also a member of the first Executive Committee of the N.S.A.S., which then had its headquarters in Manchester. His interest in and sincere concern for smoke abatement was at all times very evident, and his support and wise counsel was of the greatest value to the Society in its early days. As a speaker he combined no mean gift of oratory with quiet authority in an unusual and convincing way. He did much for the health services of Manchester and much to foster the understanding of the problems of air pollution that have kept Manchester so well in the van of progress.

Mr. J. A. Robinson

Mr. J. A. Robinson, who died at Bristol on December 21st, was another member of the pre-war Executive Committee of the Society. He was for many years, until his retirement in 1943, Chief Sanitary Inspector of Bristol, and he was one of the first Sanitary Inspectors to give active support and service to the Society. He was a member of the Committee for eight years, and co-operated wholeheartedly in the preparation of the successful annual conference that was held in Bristol in 1935. Mr. Robinson distinguished his long public health career by his efforts to gain full recognition of the important work done by the Sanitary Inspectors in the local government service: efforts which have borne good fruit.

EVIDENCE ON SMOKELESS ZONES

Our member, Mr. W. L. Mather, recently initiated a most valuable correspondence in the *Manchester Guardian* by a letter which urged Manchester to increase the pace of its efforts to achieve freedom from smoke. The stage was set, he wrote, but even if the actors played their parts at the present tempo it would take fifty years before the city was clean. " Let us take Time by the forelock before he grows bald!" This was followed by several letters from persons connected with prominent Manchester business houses, giving the sort of evidence we had been hoping for. Mr J. F. Simpson, of Simpson and Godlee Ltd., said: " This office has the good fortune to be situated within the boundaries of the zone as at present defined and there is no question of the advantages that have been gained. Windows dirty far less readily, cars left outside require less cleaning, and the colour of the fog, while still pretty horrid, is far less than in areas a mile away."

Another correspondent, Mr. E. N. Hall, of Hall and Pickles Ltd., wrote of the transformation he had personally seen in Pittsburgh, and pleaded " Let us therefore extend the smokeless zone in Manchester forthwith (our offices included!)" Mr. Alan Graham, of Kendal Milne and Co. also asked for the smokeless zone to be enlarged, and mentioned their air conditioning plant, the filters of which normally last for three years, but which in Manchester have to be renewed every six months. Mr. J. D. Brown, Chairman of Affleck and Brown Ltd., was a further business man to urge support " of any campaign to extend our present smokeless zone over a large part of Manchester."

Mention should also be made of an excellent account of the smoke problem and the Society in a Bath newspaper, initiated by another member, Mr. W. L. Dhenin. Carry on, members!

AMERICAN INDUSTRY LENDS GENEROUS SUPPORT TO THE AIR POLLUTION CONTROL ASSOCIATION

By **Thomas C. Wurts,**

Director, Allegheny County Bureau of Smoke Control

THE Air Pollution Control Association, for many years known as the Smoke Prevention Association of America, and for a short time as the Air Pollution and Smoke Prevention Association of America, dates back to approximately 1907 when a group of individuals interested in smoke prevention gathered together to discuss their common problems.

At that time there were ordinances in various cities throughout the country calling for smoke prevention but these ordinances were written without any real teeth in them and not much attention was paid to them. The general thinking at that time was to the effect that, if one's home was in an industrial community, one must put up with the disadvantages of such a community, among which was smoke. As a matter of fact, the very highly respected Chief Justice of the Supreme Court of the Commonwealth of Pennsylvania at approximately that time read an opinion of that Court which said just this in more legalistic language.

Almost from the beginning and until 1950, the Secretary of the Smoke Prevention Association was Mr. Frank Chambers who was head of the Smoke Bureau of the City of Chicago, and carried on his duties as Secretary of the Association in addition to those having to do with the administration of his Bureau.

From this modest beginning, the Association grew, gathering unto itself the heads and sometimes the members of smoke prevention bureaux as well as a good sprinkling of railroad supervisory personnel having to do with the operation of steam locomotives and supervisory personnel of other steam generating power plants, the principal emphasis being on methods for burning bituminous coal smokelessly and later of finding ways and means of abating the fly ash nuisance.

About five years ago it became increasingly apparent that there were many sources of air pollution other than those simply arising from emissions of smoke resulting from carbonaceous combustion, and a further realization of the fact that there was little knowledge not only of what constituted these various other air contaminants but also of how to cope with them.

It was, therefore, felt in certain quarters that the Smoke Prevention Association with a membership of between 275 and 300 members and dues of $10.00 a year was absolutely inept so far as coping with the many complicated problems. Either this Association must be built up into a scientific society leading the way towards proper thinking on these subjects, or one of the existing scientific societies, such as the American Society of Mechanical Engineers or the American Society of Chemical Engineers, must be enlisted to form an active branch on the air pollution control problems.

Starting with a nucleus of eight or ten clear thinking air pollution control officials, a vigorous effort was made to revitalize the old Association, change its by-laws so as to permit industry to lend its financial support and produce a real organization that could be the focal point of this entire movement. This was not easy to do. It was several years before it was an accomplished fact.

In 1950, the by-laws of the Association were completely re-written and the Association was put on its present basis. Today, thanks to the generous support of industry, the income of the Association has been increased from less than $3,000 per year to well over $30,000 per year. It enjoys the services of a full-time paid Executive Secretary, issues a quarterly journal—*Air Repair*, and is also issuing a monthly news sheet known as *APCA News*.

With the assistance of industry and the wholehearted co-operation of a number of the top executive of the larger companies, an analysis was made of the most practical methods of gaining knowledge in regard to the various polluting effluents and, after that, of determining economical and practical means for holding such effluents under control below the nuisance level. It was realized from the outset that to obtain these objectives would involve the expenditure of a very large sum of money annually. There were three possible obvious approaches to the problem:

1. Government-financed research laboratories, whether these be at the federal or state level.
2. An Association-sponsored scientific research organization.
3. Putting the problem squarely up to industry to arrive at the answers through its own investigations.

The first alternative was ruled out because it was felt that at the salaries permitted in such federal bureaux, it would be well-nigh impossible to attract the type of personnel necessary to accomplish the objectives. Second, such personnel would have to learn the manufacturing methods of causes of objectionable effluent before going further to find the remedies and last, but by no means least, it was not felt desirable to set up the bureaucratic organization necessary for this approach.

The second alternative was quickly ruled out because it was very questionable, even with generous support from industry, whether the Association was able to build up a budget of a size sufficient to support the many different kinds of research necessary. Also, some of the same questions in regard to scientific know-how personnel mentioned previously also held in this instance.

It was, therefore, apparent that the most effective, efficient and quickest approach to the many problems was to enlist the co-operation of the various industries to arrive at the desired results *through their own research efforts.*

Technical Co-ordinating Committees

Pursuant to this philosophy the Association is now in the process of setting up a committee, known as the Technical Co-ordinating Committee, which will ultimately have probably twelve to fifteen sub-committees, these sub-committees being constituted on a strictly industry basis. It is too early to tell you just exactly how this experiment is going to work inasmuch as the sub-committees are in a formative stage; however, the enthusiasm of industry is such that the chairmen of the several sub-committees are all men in the top brackets of their respective industries. At the present writing sub-committees are being formed to cover the following industries:

Ferrous Metals
Non-ferrous Metals
Central Stations
Chemical Manufacturers
Petroleum and Gas
Land Transportation
Marine Transportation
Solid Fuels
Incinerators

Further industry co-operation and financial support is being solicited and it is anticipated that, as soon as sufficient funds are available, a Technical Secretary will be placed on the headquarters' staff of the Association whose principal duty it will be to follow the activities of the various industry sub-committees, and to act as an assistant to the Chairman of this Technical Co-ordinating Committee. Dr. Edward R. Weidlein, President of Mellon Institute, has very kindly agreed to act as Chairman of this most important Committee and is putting together the various components necessary for the functioning of this activity.

These various sub-committees shall determine and co-ordinate:

1. Nomenclature
2. Types of effluent to be controlled.
3. Practical and economical methods for the control of such effluents.

Some of this work is already underway on a more or less local basis. For example: here in the Pittsburgh area the steel companies have already set up research committees to investigate practical ways and means for controlling the effluent from the various types of steel furnaces.

In the Los Angeles area the Western Oil and Gas Association has been for several years financing extensive research work, looking to the control of the effluents resulting from its particular refining processes. Some of the chemical manufacturers have already done a considerable amount of investigative work having to do with their specific problems and some work has been accomplished by the manufacturers of paper from wood pulp in connection with their noxious gas emissions.

All this could not have been accomplished were it not for the fact that industry has come to realize that reduction in atmospheric pollution is one of the best methods of making its community a better place for its employees to live. It also has come to realize that any unrecovered expense as a result of steps necessary to reduce atmospheric pollution, must be accepted as a cost of doing business.

Fifty years ago the Safety-First movement was inaugurated and today all our factories protect the safety of their workmen as a matter of course and as a good investment.

A hundred years ago the movement for sewage disposal, as we know it today, was undertaken and today this too is accepted as a matter of course.

With the wholehearted support and co-operation of industry, it is to be hoped that the reduction in the contamination of our atmosphere will be an accepted fact not in a hundred years or fifty years, but in the very near future.

Personal

The Council of the Institute of Fuel have unanimously agreed to award the Melchett Medal for 1953 to Dr. Harold Hartley, C.B.E., in recognition of his high scientific attainments in the development of domestic heating appliances coupled with the administrative skill with which he had guided a great industrial organization devoted to the practical efficient use of fuel. Dr. Hartley is Chairman of Radiation Ltd., manufacturers of heating and cooking appliances for domestic, commercial and industrial purposes. He presided over one of the sessions at the Society's Margate Conference in 1950.

Mr. J. Basil Mason has joined the Board of Judd, Budd, Ltd., as Technical Director. Mr. A. F. Whelan has also joined the Board.

Mr. Douglas Stanton Macfarlane has been appointed a Director of James Howden & Company Ltd., and James Howden & Co. (Land) Ltd.

Testing Gas Jets at Watson House

The Vital Flame

Among new films produced by the Gas Council and shown recently was "The Vital Flame," a documentary that shows the discovery and development of Town Gas in Britain. The historical part of the story—showing mainly the work of "that incomparable mechanic," William Murdoch—is well done and most interesting, while the latter part of the film, swiftly surveying the many modern uses of gas, and research, is both imaginative and instructive. Produced and directed by John R. F. Stewart, A.R.P.S., we can recommend this film for almost any programme.

Winsor lights Pall Mall with his gas lamps. Both photos from "The Vital Flame"

Other new films shown at the same time were a practical cookery demonstration "Pride and Joy," featuring Philip Harben, who could perhaps be described as the actor-chef, and a curious kind of comedy featuring Richard Hearne and Gilbert Harding.

The Royal Sanitary Institute announces that the John S. Owens Prize of £15 will this year be awarded for an essay on "The Location of Industry Having Regard to the Health of the People." Details from the Institute at 90, Buckingham Palace Road, London, S.W.1.

Bolton Health Committee have agreed in principle to the setting up of three smokeless zones in the town, and the Smoke Abatement sub-committee is conferring with representatives of the Housing Committee about proposals that have been drawn up by the Medical Officer of Health, Dr. A. Hutchison.

The Dean of Peterborough, the Very Rev. N. C. Christopherson, speaking recently said that the Cathedral had a new enemy—the smoke and dirt of the industrial city into which Peterborough had grown. It was eating away the stonework, and one of the clearest examples of its effect was at the Minster foregate. Before the war it was estimated that this would cost £1,000 to restore, but now, because most of the stone was beyond restoration and would have to be replaced, the bill would be not less than £3,000. At least £2,000 a year was needed to stop the deterioration generally.

MEETING IN BIRMINGHAM

Addresses by G. W. Farquharson and C. Nield

TWO addresses were given at a successful joint meeting of the West Midlands Division of the Society and Branch members of the Electrical Association for Women, at the Council House in Birmingham on November 27th, 1952. Mr. Farquharson, who is Hon. Secretary of the Division, gave a general outline of the pollution problem, in the course of which he had some interesting things to say about the effects of smoke on fabrics:

" The vulnerability of textile fabrics to the acidity of a smoke polluted atmosphere depends upon their chemical composition. Vegetable fibres such as linen, hemp, cotton, and jute, are examples of cellulose. Rayon fibres also have a basis of cellulose. Animal fibres such as wool and fur have nitrogen and sulphur in addition to a slight content of cellulose. The cellulose group are particularly prone to acid damage, and acids such as sulphurous and sulphuric when reacting with cellulose fibres produce a water soluble from cellulose (hydrocellulose), and these fibres become excessively tender and lose their tensile strength and so weaken.

" For example, curtains hanging at windows act as filters and catchment areas for dust, soot, and sulphurous acids which are in the atmosphere, and as the humidity of the atmosphere is constantly changing this variation in humidity assists the sulphurous acids to damage the fabrics. The curtains absorb the sulphuric moisture, then when the atmosphere becomes less humid, the absorbed acid concentrates in the fabric. A further humid spell sets in and a fresh quantity of acid vapour is absorbed so gradually weakening the vegetable fibres which lose their strength, and this is why domestic curtains last a considerable time longer in country areas than those in industrial ones. In addition, the necessity of washing and laundering fabrics of a cellulose nature in an industrial area also tends to weaken the textile fibres due to the bleaches and soaps used in the washing process."

The Case for Electricity

Mr. C. Nield, the second speaker, of the Commercial Department, Midlands Electricity Board, spoke on " The Industrial and Domestic Uses of Electricity towards Smoke Abatement." He discussed various factors, which he summed up as follows:

(1) Electricity is the only fuel service which supplies all needs.
(2) It is the only fuel where combustion of the raw coal takes place completely, scientifically and efficiently in the most modern steam raising plant.
(3) That the fuel burnt is one of very low grade which is relatively useless for any other purpose, and one which will increase in quantity per ton of coal mined in the future.
(4) That it brings forward the day of freedom from atmospheric pollution more than any other fuel obtainable.
(5) The capital cost and installation costs are relatively low.
(6) The running cost is highly competitive with even the cheapest of alternative fuels.

" Apart from these existing factors," he said, " we must also consider the future:

" It is clear that the use of atomic energy is approaching, and the use of the heat so generated can best be used on a large scale and all authorities on nuclear fission state that the first use will be in providing heat for steam raising in the electric power stations.

" Further the modern Gas Turbine is also being applied to the generation of electricity, and even experimental plants using the wind on our shores are being erected. At Bayton in Worcestershire, underground gasification of un-minable coal is taking place, and from this electricity has been generated. The Minister of Fuel and Power has said that this scheme promises well, and may lead to some power stations being built on such sites, bringing into use otherwise unusable coal deposits, from which it is clear electricity is being increasingly used and demanded, and that all signs of the future indicate that electricity is the most ideal medium of utilizing whatever form of energy we use, and it is right that we should do all we can to place this flexible, clean, cheap source of energy not only at the disposal of industry, but of the housewife too."

Mr. Nield commented on the greater use of electricity per worker that is found in the U.S.A. and sometimes commented upon by productivity teams visiting that country, with the suggestion that more electricity in industry and less in the home for cooking and water heating is a state of affairs we should emulate here.

" It is overlooked, however," continued the speaker, " that three other factors have a profound bearing on the American scene:

" (*a*) The climatic condition is quite different. They have long winters of lower temperature than here, and hence the common use of central heating as opposed to the separate room heating adopted here.

" (*b*) Due to the Oil Fields they have abundant supplies of natural gas. This is piped up to 1,000 miles to Urban Areas, the Calorific Value of this being as much as five times that of Coal Gas as we know it, which here has to be obtained from high grade coal. This use of natural Gas is now taking place in Alberta in Canada with the exploitation of the newly discovered Oil Fields.

" (*c*) Industry in U.S.A. uses the shift system to a greater degree than here, and this means that the generating plant is in fuller use for a greater part of the 24 hours—hence good load factor."

Natural Gas for Britain?

What is called " an imaginative scheme " for a pipe line for natural gas from the Middle East to Europe, is described in the *Petroleum Times* of January 23rd, from a preliminary report compiled by the Bechte International Corporation. The scheme, which is certainly vast and far-reaching in its scope and possibilities, envisages a 2,500 mile pipe line from Kirkuk or Mosul in Iraq across Europe to Paris, at a cost that works out to 25 to 32 cents per 1,000 cubic feet, or million B.Th.U. This is equivalent to about 2d. to 3d. per therm.

There are vast supplies of natural gas in the Middle East oilfields, and hundreds of millions of cubic feet are burned to waste every day. Other sources, in Kuwait, Saudi Arabia and Persia might be linked up later. The preliminary cost estimate for a first stage consisting of a single line with a 500 million cubic feet per day capacity, as far as Paris, is £150 millions. A second stage of equal capacity would cost another £125 millions.

Even if the further cost of a line from Paris to Britain increased the price per therm by one-half or even more, the scheme would still be economically attractive—or at least it is something that seems well worth the fullest possible examination and discussion.

The report points out that Europe is critically short of fuel. With an advanced industrial development and a population more than double that of the U.S.A., its countries have available for use only about one-third as much fuel.

Sulphur—Carbonization Problems—Domestic Appliances

Recent Institute of Fuel Meetings.

THREE of the meetings of the Institute of Fuel held in London this winter have been on subjects of special interest to those concerned with air pollution.

Sulphur Recovery from Flue Gases

At this meeting, held at the Royal Society of Arts on 17th December, 1952, three papers were read on the important problem of the sulphur content of the flue gases discharged from power-station chimneys.

The first paper, by Mr. R. Llewellyn Rees, Chief Chemist to the British Electricity Authority, began by tracing the historical development of flue-gas washing at power stations, and pointed out that washing opposes the good effect of a tall chimney by cooling the gas. Washing, said the author, might actually increase the local pollution in certain states of weather, and it was calculated that existing washing processes cost the community more than the damage done by the sulphur dioxide they remove. Furthermore, these processes were wasteful in that no useful material was recovered from the flue gas. The use of gas liquor for manufacturing ammonium sulphate from flue gas might, however, provide a limited solution to the problem, applicable at stations which were sited so that cooling the gas was not objectionable even when the fuel was rich in sulphur.

The second paper was by Messrs. S. R. Craxford, A. Poll and W. J. S. Walker, of the Fuel Research Station. It described the small plant which has been built at the Station to treat 1,000 cu. ft./hr. of flue gas from a Lancashire boiler, using the ammonia process of sulphur recovery which was developed before World War II by Messrs. Simon-Carves and the Metropolitan Borough of Fulham. This plant, which removes some 99 per cent. of the sulphur dioxide in the flue gas, has proved entirely satisfactory. Ammonium sulphate is produced from the scrubber liquor by a modification of the German Katasulf process.

In the third paper, Mr. S. H. Richards described a survey, carried out by the Fuel Research Station, of the concentration of sulphur dioxide in the air of S.W. London. The work was designed to study the effects of flue-gas washing at Fulham and Battersea power stations on the pollution of the air in the vicinity.

The Problems of Carbonization

Mr. H. D. Greenwood, of the National Coal Board, presented a most informative paper on "The Production of Gas and Carbonized Fuels—Today and To-morrow," at a joint meeting of the Institute of Fuel and the Southern Section of the Coke Oven Managers' Association at the Institution of Mechanical Engineers on 8th January, 1953.

Mr. Greenwood opened with a survey of the objectives of the carbonizing industries — coking and gas — which between them use some 25 per cent. of the coal produced in this country. The coking industry, which consists of two main sections—the plants operated by the N.C.B. and by the iron and steel industry respectively—carbonizes coal primarily to make metallurgical coke, but the N.C.B. coke oven plants supply in addition some 60 per cent. of the coke used by other industries. The gas industry supplies the majority of the coke used by domestic consumers. The gas industry produces twice as much gas as the coking industry, although carbonizing only about 15 per cent. more coal. A considerable proportion of the gas produced by the coking industry is used for internal purposes, and the quantity supplied to Area Gas Boards represents about 13 per cent. of the gas made by the gas industry.

The output of gas by the gas industry

might increase at the rate of about 3 per cent. per annum, and it was probable that this would necessitate the carbonization of an additional eight million tons of coal by 1960. To meet the increased requirements of coke for the steel industry and other purposes the coal consumption of the coking industry might increase by about three million tons over the same period. There might be insufficient high grade coking and gas coal available, and blending a proportion of lower grade coal would become necessary.

The availability of different grades of carbonization coals and the new coal price structure might materially affect future economics of both the gas and coking industries. It might be economic for the gas industry to develop methods of complete gasification which could use coals unsuitable for carbonization. Tests on British coals in Lurgi high-pressure gasification plant have recently been carried out.

Over the next few years about a third of the present capacity of the coking industry would have been replaced by new plant, and the present methods of coke production were thus established for some time ahead. The cost of new carbonizing plants had increased considerably in recent years, but this had to some extent been compensated by lower operating costs due to improved techniques.

The consumption of coke for industrial and domestic consumers (excluding the iron and steel industry) had been increasing at about one-third of a million tons per annum, and corresponding to the increase in gas consumption the availability of coke might continue to increase at a similar rate. In view of the shortage of carbonization coals any larger expansion in the use of carbonized fuel might have to be based on the use of coals not normally used for carbonization, and methods of production of domestic fuels from non-coking coals were being investigated.

The production of smokeless domestic fuels from non-coking coals would involve briquetting, but it might be possible by the use of new techniques, by which the rate of carbonization can be materially increased, to reduce the costs of the actual carbonization process.

The Efficiency of Domestic Appliances

A paper on the " Efficiency of Domestic Space-Heating Appliances Using Solid Fuel," by L. L. Fox, B.SC., F.INST.P., of the Fuel Research Station, was presented at a meeting of the Institute on 27th January, 1953. It had previously been printed in full in the Journal of the Institute, November, 1952. The paper can best be summarized by giving the author's conclusions in full, as follows:

" Since the war the domestic fuel policy has been, by a scheme of testing and approval, to foster the production of improved multi-fuel domestic heating appliances and to bring about a gradual change-over from bituminous coal to solid smokeless fuel. Against this background two facts are now emerging. First, there has not been an increase in the availability of solid smokeless fuel for domestic heating. Secondly, the improved appliances have been designed primarily to be coke-burning in order to meet the standards of performance to which they must conform in order to be classed as ' improved.'

" The ' improved ' appliances attain higher test-bench efficiencies with gas coke than with bituminous coal, but if the overall thermal efficiency of the gasworks process is applied to the efficiencies with gas coke, there is little to choose between the two fuels. As a generalization it can be stated that the test-bench efficiencies of the ' improved ' appliances when burning bituminous coal are about 75 per cent. of the corresponding efficiencies when burning gas coke.

" The ' improved ' appliances without boiler have test-bench efficiencies ranging from 25 to 40 per cent. when burning bituminous coal. The corresponding figure for the ' ordinary ' open fire is about 25 per cent. When water heating is included the test-bench efficiencies of the ' improved ' appliances range from 30 to 50 per cent., compared with about 30 to 40 per cent. for an ' ordinary ' open fire with back-boiler—both when burning bituminous coal. The greater degree of control over the rate of combustion which the user can exercise with the ' improved ' open fire is not taken into account in the test-bench tests.

" The test-bench efficiencies of open fires and openable stoves for space-

(*Continued at foot of next page*)

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Smoke, Steam and Sun

heating are often compared unfavourably with the high figures quoted for Continental closed stoves. Apart from questions of appliance design, a difference is to be expected owing to the different methods of test, the British method depending on the measurement of identifiable heat outputs. Although the bench test gives minimum efficiencies, it has served and is still serving a very useful purpose in helping in the design of better appliances. The proper use of the test-bench results is to enable appliances of a given type to be placed roughly in order of merit as regards efficiency.

" In making a comparison between appliances of different types it is necessary to consider their respective performances when installed in a house. The comparison should therefore be made on the basis of a room-heating efficiency. In defining room-heating efficiency it is necessary to take into account the amount of the flue-gas volume flow.

" It is suggested that the efficiencies which have been quoted, together with the fact that about 87 per cent. of the solid fuel used directly for domestic heating is raw coal, point to the conclusion that the time has come to press for the development of more efficient coal-burning space-heaters."

Microwaves can now be used to measure minute amounts of smoke in the air, according to *Science News Letter*, Washington. A machine has been adapted at Indiana University that pipes the ultra-high-frequency radio waves into two test chambers. One chamber is filled with pure air, the other with air in which are traces of smoke. Travelling at different speeds through the two air samples the microwaves measure the amount of smoke down to as little as 6/100,000ths of an ounce per cubic foot of air.

Smoke Abatement and Fuel Economy in the Home

By

M. Barash

AT a meeting of the East Midlands Division of the Society at Derby on November 13th, 1952 a comprehensive paper, with the above title, was presented by M. Barash, PH.D., M.INST. GAS E., M.INST.F., F.R.I.C., who is Coal and By-Products Officer to the East Midlands Gas Board. The length of the paper unfortunately prevents its full recording in these pages, nor does its balanced analysis of the problem lend itself to any fair selection of extracts.

" The unavoidable association and the close relationship of atmospheric pollution and the domestic grate," said Dr. Barash, " have been recognized and talked about for many years and from all platforms, from our Parliament to the local Parish Hall.

" A more widespread consciousness in this connection appears to have developed, however, within the last decade or two; and the matter of fuel economy has become even more prominent in the last two or three years owing to the grim fuel supply position in general.

" It is particularly noteworthy and redounds to the credit of our administrators and their advisers that even during the grimmest period of the last world war, interest in these matters was vigorously fostered. Already in 1941 there were looming on the horizon the tremendous problems of rehousing and rehabilitation which would be inevitable when the colossal destruction and disturbances of the war came to an end. And long before hostilities ceased, during the latter part of 1944 it had become very obvious that one of the largest and most acute problems in the rehousing programme would be the supply and efficient utilization of fuels."

The paper then examines the efforts made by Government committees to survey the fuel and power problem and to formulate policies. The Egerton, Simon and Ridley Committees are considered in some detail, and a number of their findings are quoted.

On the Egerton Report, " The Heating and Ventilation of Dwellings," Dr. Barash summed up: " Thus, for the first time in history we were supplied with an objective to which the architect can build up his designs, with a measure to which the appliance manufacturer can safely go into production, with a standard of comfort and convenience which the householder can justifiably expect and look forward to with reasonable assurance."

Dr. Barash reminded his audience that the long-term programme recommended by the Simon Committee proposed " the target of a national domestic fuel policy to secure that the 50 million tons of bituminous coal, now burnt (in existing grates) with a working efficiency of 20 per cent., should be replaced in 20 years by smokeless solid fuel or by bituminous coal burnt smokelessly, or by gas, or by electricity, with an average coal economy efficiency of not less than 40 per cent.

" This would render possible:

(1) The virtual abolition of domestic smoke;
(2) Less labour and dirt in the house; and
(3) Either—
  (*a*) Doubling the useful heat in the smaller houses at little or no greater cost to the householder and no increase in the consumption of coal; or
  (*b*) An increase of 50 per cent. in the useful heat in the smaller houses with a substantial reduction in cost to the householder and a saving to the nation of perhaps 10 million tons of coal per annum."

" Before coming to the Ridley Report, it would be useful to survey what steps have been taken since the publication of these two earlier Reports, and what steps are further contemplated towards implementing the recommendations and achieving the objectives laid down by these two Committees.

" It will be realized that not only have the relevant Government Departments to be enabled to move freely and effectively, but Local Authorities, builders and manufacturers have to be educated and led, and above all, the consumer, the householder, has to be gently but firmly convinced that all this is being done ultimately for him and his special benefit as a unit and as an integral member of the community.

" (1) Firstly, what I consider to be an important and very valuable step was the formation in 1946 of an Inter-departmental Committee composed of representatives of the several Ministries and Government Departments concerned with housing (Health, Supply, Works, Fuel and Power, Board of Trade, and Department of Scientific and Industrial Research); the purpose being to eliminate overlapping and avoidable delays, and to stimulate the expeditious placing of orders and the general smoothing out of programmes and policy.

" (2) Cordial relations were established and are being maintained by the official bodies with individual and organized contractors and fuel-burning appliance manufacturers in connection with the design and production of new models of highly improved appearance and efficiency. I was privileged to be a member of a small team of technical representatives appointed in 1945 by the Ministry of Fuel and Power in conjunction with the Fuel Research Section of the D.S.I.R. to make a rapid and intensive survey of the works of these manufacturers. This tour of inspection covered 40 to 50 works (over 75 per cent of the total production capacity of the country) and proved extremely valuable from numerous aspects—affording information about: potential rates of production; steps necessary to increase production where and when desired; estimated costs; the trend towards improved appliances; and the exchange of information with regard to desirable improvements which had not yet become common factors. A most satisfying impression gained from these visits was the prevalence of the desire to implement the two parallel considerations of fuel economy and smoke abatement.

" (3) British Standard Specifications and Codes of Practice are being developed, and several have already been published, clearly defining the quality, performance and efficiency of appliances; methods of testing their performance under varying load conditions; and every aspect of the construction and utilization of fuel consuming appliances.

" (4) Attractive Exhibitions and Conferences are being arranged and held all over the country, at which by printed word, skilful demonstrations, lectures and discussions, much useful information has been and is being disseminated among all classes of the community.

" (5) Reference must also be made to the valuable work which has been done by Housing Managers and their staffs and by Women's Organizations in advising and assisting housewives in the new houses (prefabs particularly) to fully understand and obtain the best results from their modern new fuel appliances and installations.

" (6) And last but not least, mention must be made of the arrangements which have been developed and organized for complete investigations and 'field tests' to be carried out on fuel burning appliances of all types, on existing models, on new models in production, and on prototypes proposed for future production. These tests were, in the main, carried out at the Fuel Research Station (D.S.I.R.), and at Watson House, but a subsidiary service was also operated in which such tests and investigations were officially supervised at the works and testing stations of the manufacturers themselves. The results of these tests and the observations made during the investigations have considerable influence on decisions regarding the placing of appliances on the accredited lists of 'approved appliances' for new housing schemes. Suggestions with regard to modifications found to be necessary were freely discussed during and after the investigations with the manufacturers concerned. The manufacturers welcomed and obviously appreciated this service."

Dr. Barash then reviewed the Ridley Report, and quoted a number of its recommendations. (It will be recalled that the Report was the subject of an article in the last issue of this journal). A number of critical Press reviews are usefully quoted.

Equipment and Appliances

The paper then discusses modern equipment and appliances—the development of the "house engine" units, solid fuel burning appliances, gas and electrical appliances. The national aspects of coal conservation are considered, and attention drawn to the "coal equivalent" of various types of heating, much important comparative work on which has been done by the D.S.I.R. Building Research Station at its experimental housing estate at Abbots Langley. The tests have shown, Dr. Barash pointed out, "that the coal requirements may be as high as seven tons per annum with some combinations of modern appliances, but that 'with a suitable combination of gas and coke appliances, a modern service can be given for the expenditure of as little as four tons of coal per annum.'"

As the questions of coke availability and coke quality are being given much attention, and as Dr. Barash is an authority on this fuel, we quote in full his remarks on these:

"The question of coke availability naturally comes forcibly to mind, and I will only draw attention to two aspects of the potential increase in domestic consumption of coke:

"Gas coke production (availability for sale) in this country has increased from about 7 m. tons in 1939 to 10 m. tons in 1950, and only about 2½ m. tons of this is used today in the domestic market. If the virtues of domestic coke-burning appliances are sufficiently appreciated by Authority and by the potential consumer, there appears to be no insurmountable reason why, on a short term policy, this 25 per cent. fraction should not be very materially increased.

"And as a longer term policy, if domestic coke consumption be appreciably increased, there should obviously be a very material resulting decrease in the 30 to 40 million tons of coal wastefully burned annually in the domestic grate. A large proportion of this 'domestic coal' or 'house coal' is excellent bituminous gas coal—and the diversion to the gas industry of the saving from house coal consumption would pay three-fold dividends in increased coke production at the gasworks.

"This theme of coke availability is elaborated in the Ridley Report.

"Reference, however brief, must be made to *Coke Quality*. Unfortunately, we are not in the position today that we were in before the last World War regarding the control and development of coke qualities for specific usages.

"In the last few years before the war, when a glut of coke made selling competitive, and when we had a free choice in the selection of our coals for carbonization, excellent progress was made in the gas industry in the production of really attractive, free-burning, highly reactive cokes for the domestic market. (I refer to such cokes as 'Dryco,' 'Glico,' etc.).

"Today the wherewithal and the incentive have been more or less taken away—and it has to be admitted that apart from effective grading, coke quality (for domestic use) is not as good as it has been.

"There is one partial compensation in that the development of highly efficient domestic coke-burning appliances enables such coke as is available to be consumed in general much more readily and effectively than formerly."

Conclusion

Concluding, the author said:

"I am coming to the end of my paper, and it might appear to you from what I have said that I am prejudiced in favour of the use of the products of the Gas Industry to effect 'Fuel Economy in the Household.'

"My prejudice is based on two overriding considerations: One is *smoke abatement* or smoke elimination.

"The other is that in the four million new dwellings which are contemplated as essential in the next 10 years, by using gas and coke for providing the domestic heat services in these dwellings, *a saving of at least seven million tons of coal* can be made annually in comparison with other methods of supplying equivalent heat service.

"Both these matters cry for urgent attention; and above all we must not allow any smugness in achievements with our new schemes to lessen our endeavours to clean up the old prevailing messes.

"I feel that we have certainly become more conscious during the last few years than at any other time in our past history of the mistakes we have made, and are making, in the misuse of our fuel—the wastage of our coal reserves, our only real national material asset—our abuse at the expense of posterity of the valuable heritage laid down for humanity over many millions of years—our lavish expenditure individually of disproportionately large amounts of fuel, income and energy, without deriving anything like the comfort and amenities which could have resulted—and finally we are opening our eyes to the self-inflicted injury to our health produced by fouling our atmosphere (Nature's prodigal gift) with the smoky and sulphurous pall which we belch forth from our domestic chimneys.

"The result of this awakening of conscience is that we now 'have the tools' and, as our American friends would say, we have the 'know-how'; the incentive has been with us for many years. Then what is lacking? A serious effort by our

(*Concluded on page 130*)

Smoke Prevention—Problems and Prospects

From an Address by the General Secretary to a Meeting of the Yorkshire Division in Leeds on 28th November, 1952.

I ALWAYS feel that one of my most important duties to the Society is at times just to sit back and think about it and its problems. This talk is going to be little more than a few disjointed reflections that it is hoped may help us to see where we stand.

We cannot of course judge our progress by looking only at where we stand. For that we have to look back to where we were, forward to where we are hoping to go, and note the rate at which we are moving.

A generation ago, even only a couple of decades ago, we were just as sure as we are today on what we wanted—namely, clean air. But we were rather like our interplanetarians are at present, planning a trip to Mars—the destination was known, but the means of getting there were very vague and doubtful. And we had little support outside our own small company. We were only just emerging from the still earlier phase in which all reforms begin—of being regarded as a bunch of cranks and long-haired visionaries. Not only was there general apathy about smoke prevention, but a certain amount of derision and even hostility.

Progress

Now let us compare our position then with that today, at first in its most encouraging form. We find that the means—the actual technical methods—for the abolition of most pollution are known and in being: our problem now is simply to get them applied everywhere. This applies to nearly all forms of air pollution, although there remain a few " hard core " problems of industry, largely concerning sulphur gases, grit and dust. But even here the needs are known, and the means can undoubtedly be developed by more effort and research: the problem for us is first to get this effort and research moving more rapidly. And above all, the desirability of smoke prevention is now unquestioned. It receives the approval and goodwill of all thoughtful and responsible people. It has had the backing of important Government reports—first the Egerton report, then the Simon report, and now the Ridley report, the last with its special Appendix IV, which in many respects could have been written by the Society itself. The Society's own reputation and influence have steadily grown, and another noticeable change in recent years is the larger number of people who are now not just acquiescent to our work but are actively smoke-conscious. That is a further sign of our success, although sometimes these new recruits turn and blame the Society for the fact that there is still so much smoke and other pollution.

Problems

And, admittedly, if we look at the picture in another way, without contrasting today with yesterday, we see that there are still many problems to be dealt with, and even signs here and there of retrogression rather than progress.

We see new sources of pollution appearing, without having been given the necessary pre-natal treatment. We see that although there is much verbal support for smoke prevention there is precious little positive action; that although Committeees may report Governments continue to do nothing; that although the Society has made progress it is still a puny David battling against a colossal Goliath.

One could spend much time on analysing, explaining and reconciling these divergent views, but to cut the philosophizing short, it seems that we can get to the heart of the problem of our progress in one word, even though unfortunately it happens to be one of those vogue words of which some of us may be a little tired. It is *priorities*.

Priorities

What I mean by this is that at whatever aspect of the pollution problem we look, whether it is the supply of smokeless fuels for our homes, the electrification of the railways, or the modernization of industrial plant, our case may be admitted and supported, but that little or nothing happens, or happens only with maddening slowness, simply because other things have higher priority. It may be a question of capital investment, supply of materials, preparation of plans, research, or just getting the attention of the men who can start things moving. All that we want may be accepted in principle, but so many other things are deemed to come first. Clean air, that is, has a low priority. Competition with other needs is intense, and generally speaking clean air does not make the grade as we would wish.

This brings us to the question we have all no doubt asked ourselves: why when everyone agrees about the need for smoke prevention, is so little done about it? Why does it get so low a priority? This too, in its turn, appears to be a matter of priorities: this time our individual priorities. Life is busy and complicated enough for most of us; we cannot devote time and thought to all the things we are concerned about, or would like to be concerned about. We too have to make, though perhaps unconsciously, our private priorities. And the trouble is that our subject of air pollution normally contains too little of the ingredients that are needed to give top priority—self-interest, sense of duty or of responsibility, sentiment or emotion. Most agree with us, many applaud, but very few have time to help.

Putting Over the Case

Here we come to another key problem. The case for the prevention of air pollution is overwhelming. But it is a sober intellectual case. It does not rouse the passions or provide an emotional outlet for its adherents. Its appeal is even weakened by the complexity of the harm done by pollution. Before our audiences have assimilated the case on the health side we are talking economics to them; and before the loss in food production has been appreciated the loss of fuel is being discussed. It is a powerful case, and when understood cannot be easily forgotten; but it does not possess that neat simplicity of one cause one consequence that is necessary for a truly popular campaign.

The ceaseless, uninterrupted outpouring of pollution also means that although we all suffer from it—in health, amenities, hard cash, and so on—it is all too familiar. The effects are continuous and chronic, rather than sudden and acute, as in an epidemic or a street or railway accident. We tend to accept polluted air and all its dirty consequences in the way that squalor always comes to be accepted by those who live in it. Only when there is a really outrageous local nuisance from an identifiable source do people get worked up about smoke, and when that is abated so is their zeal. If all the harm done by air pollution in the course of a year could be concentrated into a single day, or hour, the catastrophe would be so startling that the problem would at once be given top priority and would be solved in no time.

But in the absence of any such miracle we will find it useful to consider what can be done to give smoke prevention the higher priority it deserves in both public and private life. That, in a nutshell, is one of the two principal tasks of the Society. The other is to help those who have given it the necessary priority.

There seems to be no short, clear-cut solution to the problem. We must go on pegging away with all the means at our disposal, working all the time to get higher priorities for smoke prevention purposes in every sector that requires it—legislation, administration, new capital investment (as in carbonization plant), new equipment for industry, research, and above all in public opinion and conviction.

It is a big programme, and even to state it so baldly as this prompts questions about the prospects of progress and how should it be tackled.

Cutting Our Coat

This brings us to still another sort of priorities. We can draw up, quite easily, a fine programme of activities for the Society that should be pursued, all of them important and useful. But the cost will be far beyond our present resources or those of the movement as a whole. We are obliged to cut our coat according to our cloth, and to put the work that might be done in order of priority, balancing value with cost all the time.

This sounds simple, but in point of fact it is one of the most difficult tasks of all in the running of the Society. Many of our members and friends have their own ideas, and they are nearly always good ones in themselves, on what ought to be done. Unfortunately, on our meagre budget they are not all compatible with each other, so that the question of what not to do becomes more tricky than that of doing. Much of our work is of course routine, about which no discussion is needed; other jobs are obvious—like preparing and submitting our views to the Ridley Committee—but in the field of general propaganda it isn't easy to balance all the claims for attention. Speaking personally for a moment, I am afraid I cannot avoid at times seeming to be lukewarm about schemes that are propounded, simply because they cannot be done properly on our resources, or attempted only by neglecting or dropping something else of proven value. And one thing about educational and publicity work such as ours is that it is better to concentrate your strength on a few objectives that will " go," than to disperse it thinly and therefore ineffectively over too wide a field.

At headquarters the work that is given top priority starts with matters of membership, subscriptions and accounts. If that is neglected everything goes to pieces. Next comes the work in connection with the Executive Council and Committees, and then follows the production of *Smokeless Air*. This is put high because it is the one intimate contact we have with all our members, and by keeping them always informed and interested holds membership together. Our membership turnover is very small, and I am sure this is largely due to the regular receipt of our journal. And we have to remember that there are ten readers of *Smokeless Air* for every member who attends a meeting. Then comes work on the annual conference, which demands its own strict time schedule. After that are the varied tasks of answering inquiries of all kinds and from all quarters, supplying publications and references to publications, and generally acting as the national information bureau we seem to have become. Over the years this work—broadly, public relations—does much to build up prestige and influence. Exhibition work, loan of materials for exhibitions, lecture services, and the production of other publications, such as the Year Book, are also activities that cannot be ignored. This work, and much else of minor interest, keep our small staff fully occupied, and it may be confessed that there is much back-room work—such as on library records—that has had to be neglected.

Now, obviously, this deplorable negative problem of having to decide what not to do would be eased, and would even disappear altogether, if our resources were expanding at the necessary rate. But we are still working on a shoestring, and the work of getting more income is one that should be given a higher priority than has been possible so far. As soon as more money can be spent, and more staff trained, we can move into many fields of activity from which we at present are barred. More publications, newspaper articles and letters, film and film strip lectures and services, travelling exhibitions, investigations, technical services—the list of possibilities is long and tempting.

All this, of course, is about our own internal problems, which I feel it is desirable to discuss with members, who, if I am thinking wrongly, will no doubt put me right. While it is easy enough to talk about our problems it is more difficult to describe our prospects, and beyond the prospects of our own organization those for smoke prevention itself. But I am convinced that the two are bound closely together. Clean air would no doubt come some day, NSAS or no NSAS, but it will come much sooner if all the tasks that are necessary to achieve it are continuously being initiated, stimulated, criticized, and prodded forward by a responsible, experienced body such as ours.

In this work we cannot bank on short cuts or spectacular leaps to success. The prospect is of more years of steady if undramatic progress, broken, as always, with occasional disappointments and frustrations, which we must learn to put in proper perspective. On the other hand, the steady rise in public opinion that is now apparent may, one of these days, lead to some sort of crystallizing process of recognition that will swiftly promote clean air to a much higher rank in the hierarchy of the priorities.

Smoke Abatement and Fuel Economy in the Home

—concluded

leaders in conjunction with our scientists, technologists and local government bodies! If the concerted effort on the part of individuals is not forthcoming to cure ourselves of our evils then I would even be prepared to advocate that drastic legislation should be introduced to ' finish the job.' "

Smoke and Lung Cancer

R. E. Waller, who read a preliminary paper on the subject at the N.S.A.S. Margate Conference, 1950, has published a full record of his work on "The Benzpyrene Content of Town Air" in the *British Journal of Cancer* (1952, Vol. VI., p.8), a reprint of which has been received. In summary, the paper states that benzpyrene has been detected in samples of smoke drawn from the air at eight different towns in England. The concentration rises sharply during the winter and there is a tendency for the mean annual values to increase with the size of the town. A large part seems to come from domestic fires, but it has been detected also in the exhaust from internal combustion engines. None has been found in cigarette smoke.

Tentative conclusions that there is an association between tobacco smoking and the incidence of lung cancer have had some confirmation from a statistical inquiry involving nearly 5,000 patients and carried out under the director of the statistical research unit, Medical Research Council (Prof. A. Bradford Hill) and colleague (Dr. R. Doll) (*British Medical Journal*, 1952, 2, 1271-86). Though no causative agent has been found by other workers in this field, the statisticians advance the theory that an agent only weakly carcinogenic in itself may become dangerously active in urban areas in the presence of atmospheric contaminants, such as benzpyrene.

At a cancer research conference in Bombay on December 31st, 1952, Dr. F. Bielschowsky, Director of the Cancer Research Institute at Otago University, Dunedin, compared lung cancer death rates in New Zealand with those in Britain. The two countries had the same racial stock and cultural patterns, had exactly the same tobacco consumption per head, namely 5 lb. a year, and yet the incidence of lung cancer was definitely lower in New Zealand than in Britain. In Britain 2.2 per cent. of all cancer cases were lung cancer, whereas in New Zealand the figure was 1.37 per cent. "The density of population in Great Britain," he said, "the intensity of sunlight in New Zealand, and the loss of ultra-violet rays typical of Great Britain with its layers of smoke haze appear to be factors accounting for the lower incidence of cancer of the lungs in New Zealand."

GLASGOW FOR THE 1953 CONFERENCE

The Society's annual conference this year will be held, by kind invitation of the Lord Provost and Corporation, in Glasgow from Wednesday, 30th September, to Friday, 2nd October. Notices and registration forms will be sent to all members in the near future.

We are pleased to be able to announce that the Des Voeux Memorial Lecture at the conference will be given by Sir John Charles, Chief Medical Officer, Ministry of Health, on the subject of the London fog of December last.

The Presidential Address, by Alderman Professor F. E. Tylecote, whose term of office comes to an end at this conference, will be on the subject of "The Local Authority and Smoke Prevention."

The conference sessions, now being arranged, will probably include a symposium on solid smokeless fuel, with reference to use, development, price and availability; a report on the working of the Manchester smokeless zone and plans for its extension; and a comprehensive paper on pollution problems arising from the use of liquid fuels. The Annual General Meeting will be held as usual during the course of the conference.

The Scottish Division had intended to hold their own annual conference in Glasgow, but in view of these arrangements they will be meeting, on Thursday and Friday, 28th and 29th May, at Galashiels.

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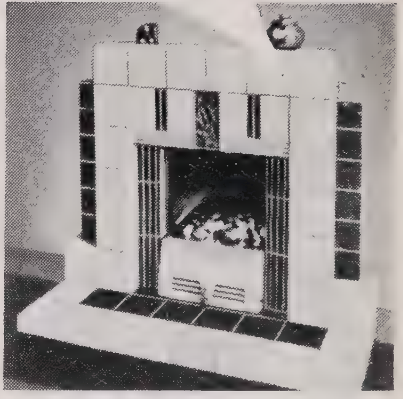

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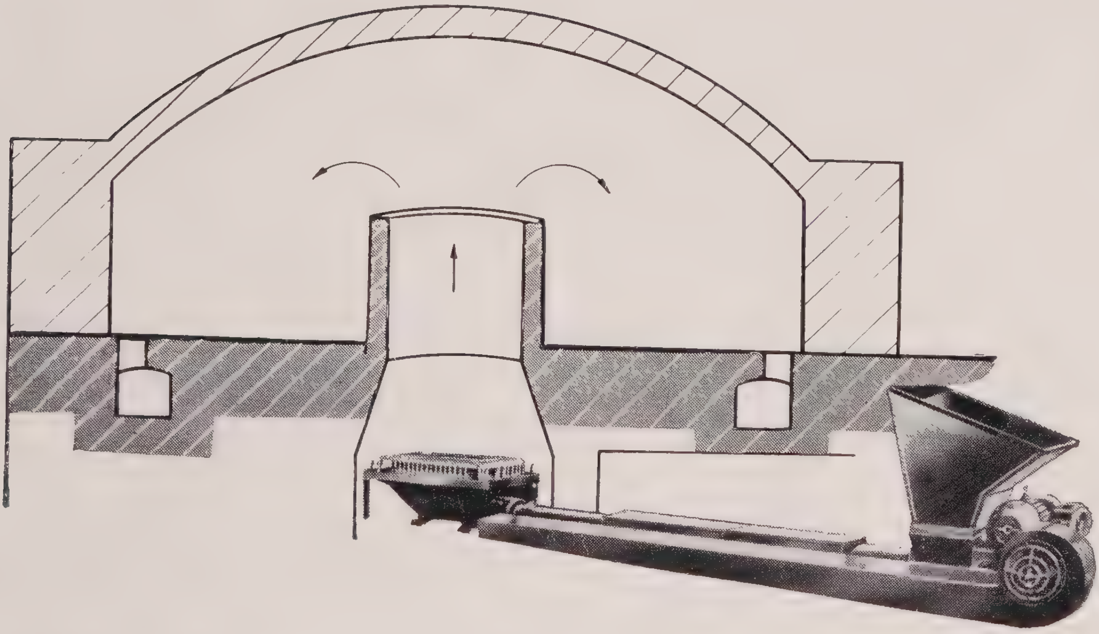

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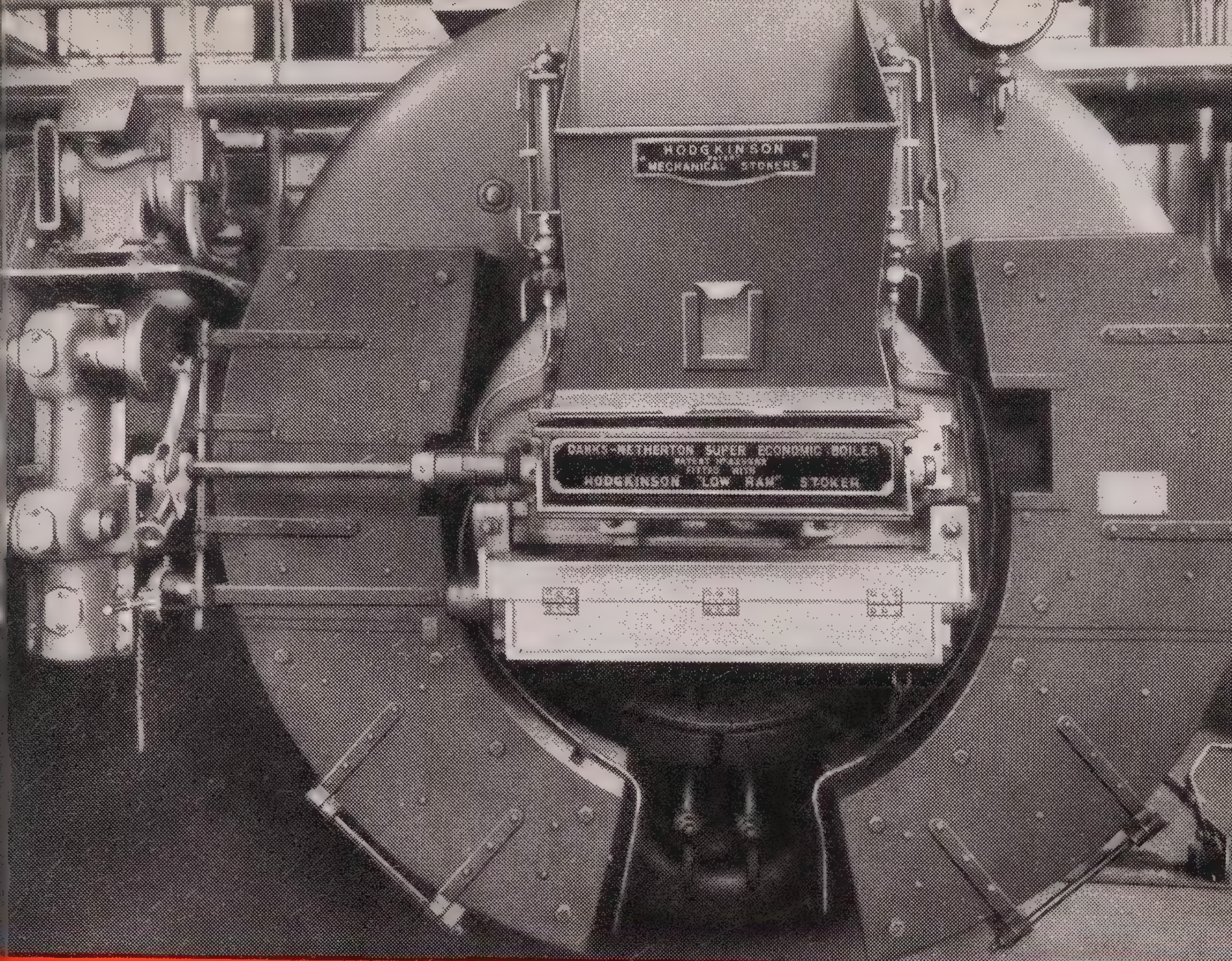
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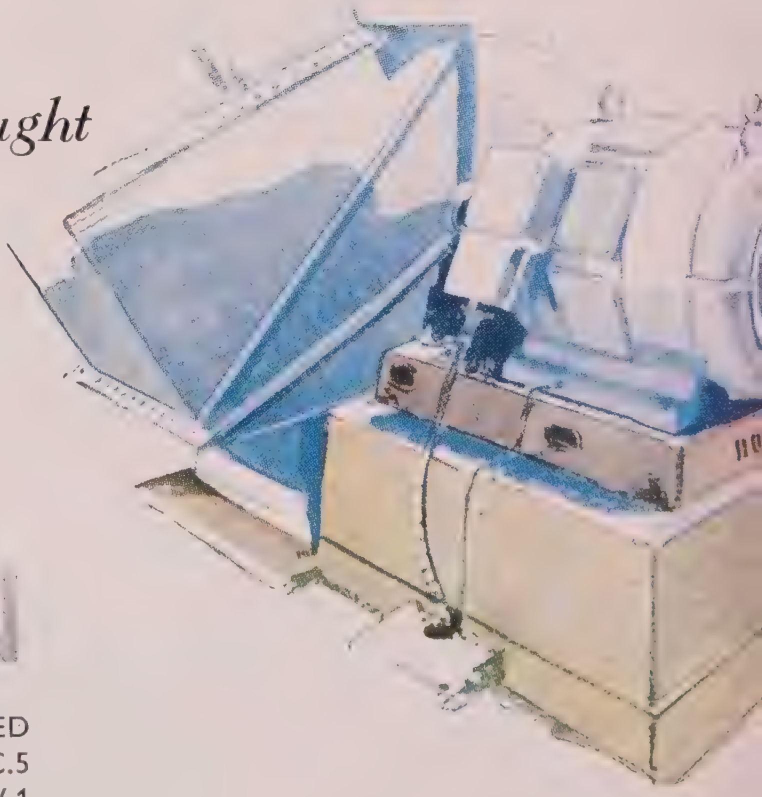

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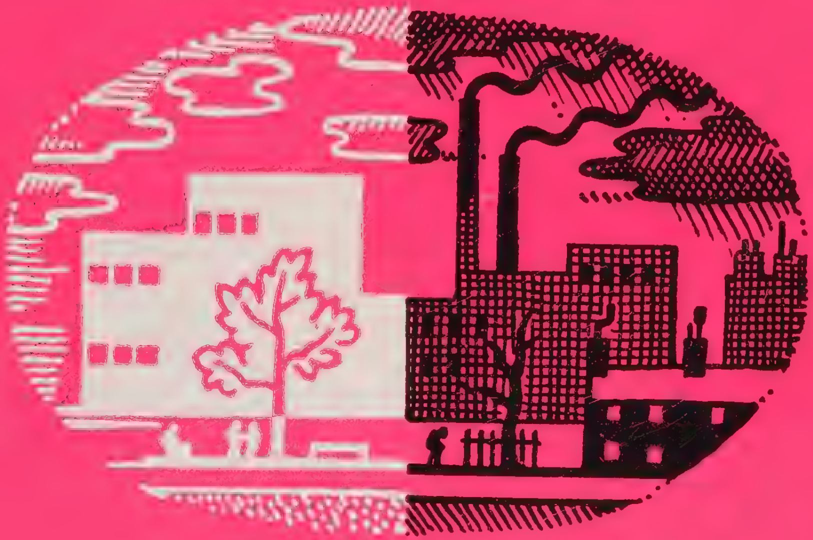

No. 86 SUMMER 1953

ONE SHILLING

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Air Pollution in South Wales
A Note on Synergism
Smoke Haze over the Isle of Man
Pittsburgh Today

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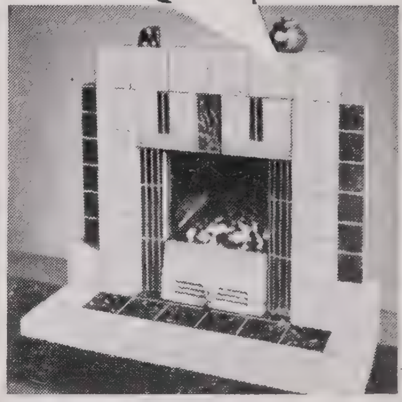

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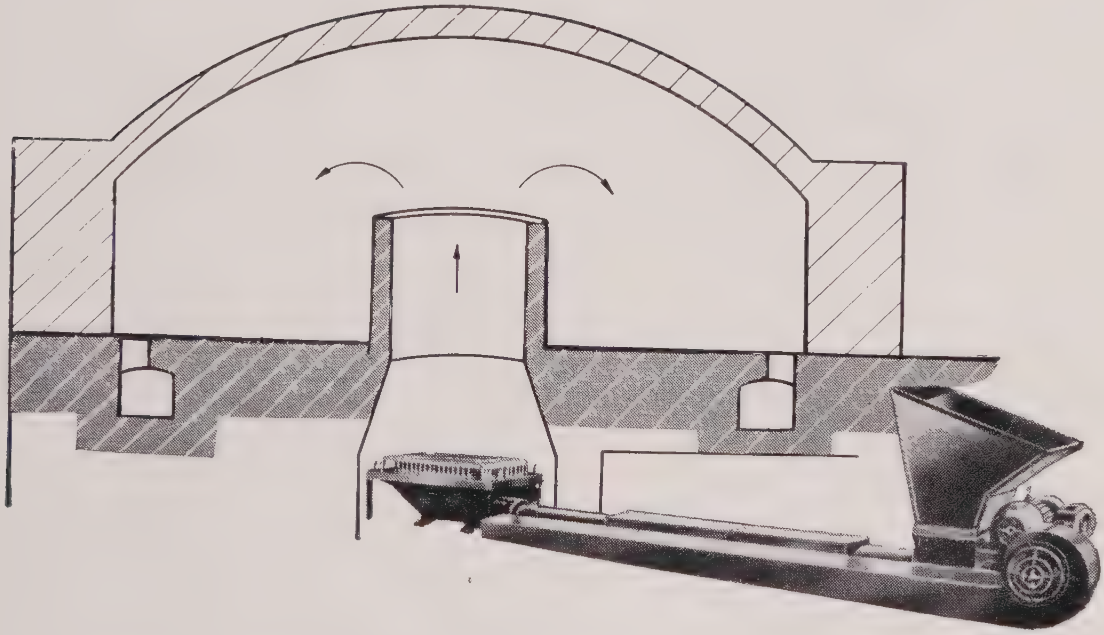

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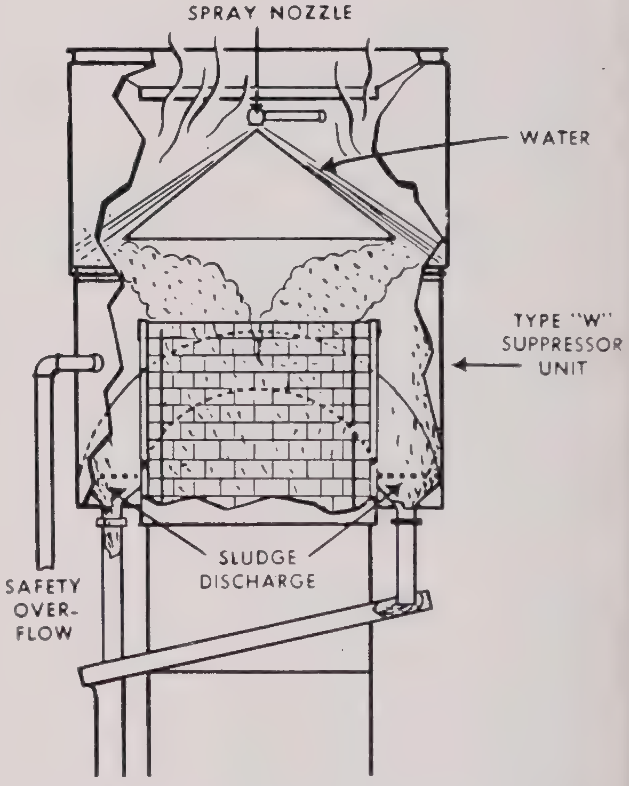

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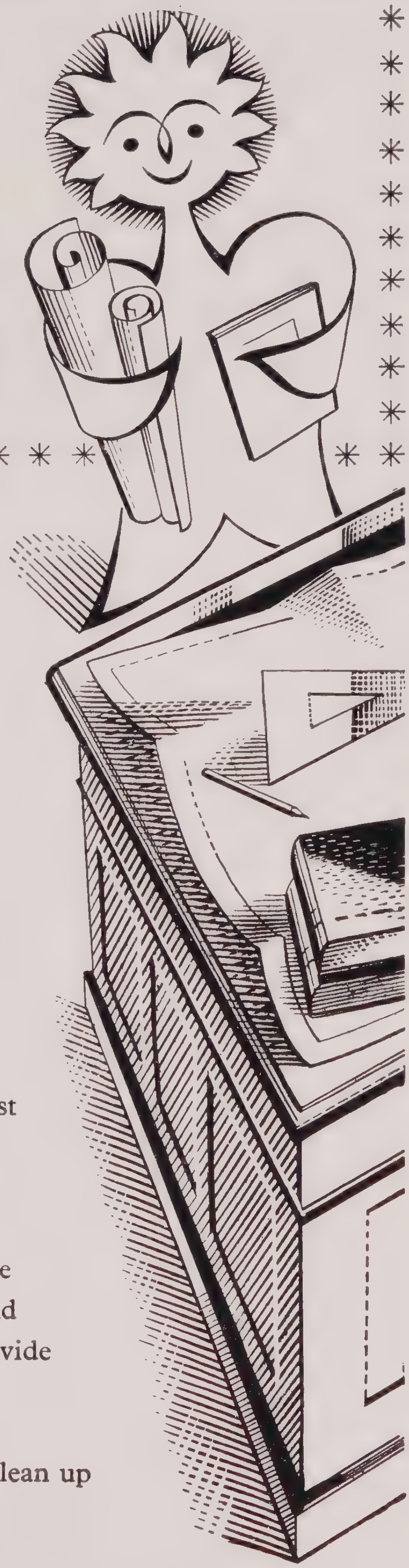

Fog is a menace equal to the worst epidemic diseases. During the bad fog of the first week of December, last year, there was a greater jump in London's death rate than during the worst week of the terrible cholera epidemic of 1866. Fog's annual toll in death and disease, to say nothing of the heavy cost to trade and industry, makes action imperative.

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SMOKELESS AIR

Committee of Inquiry

The first major consequence of the concern aroused by the London fog disaster is the setting up by the Government of a Committee of inquiry into atmospheric pollution. By the time this journal appears the terms of reference and membership of the Committee may have been announced, but we gather that it will not be an interdepartmental committee as was first indicated, and it will have an independent chairman. It is an important step forward that will be warmly welcomed by the Society, for at the very least it will focus public attention on the problem in a fresh way, and, on the other hand, may well succeed in obtaining for " smoke abatement " that all-round higher priority of planning and action—of bold planning and radical action—that is so urgently needed. The case it has to examine is now so well-documented that the Committee can hardly fail to produce a report that will be welcomed by the Society. The hardest task of its members may well be to produce a report in so compelling a form that Government action on the required scale cannot be evaded. Perhaps to begin with they may like to note and bear in mind the words of their predecessors of the Newton Committee on Smoke and Noxious Vapours Abatement of 1920, which in their report sadly and prophetically commented: " No Government has, for many years, taken any action with the exception of appointing committees, whose labours have had little or no result."

A Significant Vote

The National Council of Women, one of the largest and most influential bodies of its kind, which has many other organizations affiliated to it, is holding its annual conference at Nottingham in July. Its procedure on resolutions is to print and circularize well in advance all the resolutions sent in by branches and affiliated bodies, and then to hold a ballot for which of these shall be moved and discussed at the conference. This year 44 resolutions were sent in, from among which a mere six had to be selected. Among them was one on air pollution, from the Teddington and Hamptons branch of the Women Citizens' Association, and it is gratifying to see that it has been voted for as one of the final six. This is the first time, we believe, that the subject has won a place on a N.C.W. conference agenda. We should like to congratulate the Teddington and Hamptons W.C.A. on their initiative and to hope that they succeed in getting the resolution passed with unanimity and acclamation.

The Resolution

The full text of the N.C.W. resolution, for the record, is as follows:

" The National Council of Women in Conference is appalled at the grave consequences of the London smoke-fog of December, 1952, which, with its death roll of 4,000 makes it (in terms of human life) one of the greatest disasters to have been experienced in this country, in time of peace, for many years, and which also caused illness or distress to many thousands more. Recognizing that such fogs may occur again and that the pollution responsible for such a disaster is operating continuously, though in a lesser degree, the conference calls on all concerned, and particularly the Government and Local Authorities, to give much higher priority and urgency to the problems of air pollution, including:—

(*a*) enforcing the existing law and strengthening it to give greater control over all forms of pollution, with powers of prior approval over possible new sources; (*b*) taking steps to promote the greater production of smokeless fuels for the home to be sold at prices that make them attractive in comparison with raw coal, and encouraging their use; (*c*) encouraging and extending smokeless zones, the practical value of which is being proved by the success of the pioneer zones in Coventry and Manchester; (*d*) assisting more actively in the creation of an informed public opinion on the importance of a clean atmosphere and the means for achieving it."

Year Book, 1953

Members will have received the Society's new Year Book, which it is hoped will be found to be useful for reference and information as well as a concise record of the Society's own affairs. The general information section seems to be steadily expanding, and this new edition includes, for example, the appendix on smoke abatement from the Ridley Report and a summary of the main facts and figures on the London fog. For readers who do not receive a free copy the Year Book is sold at one shilling per copy, or 1/2d. by post.

South East and South Wales

Divisional Councils of the Society's members have been set up in each of the electoral divisions, with the exception of the South East and South West, and very successful they have proved to be. (The difficulties that have for the time being halted the North East Council, because of an interpretation of the Local Government Act that fortunately remains peculiar to that area, are another story.) The South East Division is the strongest of all in membership, and there has been a growing demand by members that they should be able to meet divisionally as do members in other areas. A meeting is therefore being held in London on 26th June to consider the setting up of a Divisional Council. It is hoped that the proposal will be approved, for by reason of the varied nature of the membership in the area, and the many opportunities for useful activity that it provides, a South East Council should be able to do a great deal to further the work and growth of the Society.

The South West, as defined in the constitution, is a difficult area to organize, the two areas mainly concerned—South Wales and Bristol and district—being somewhat remote from each other. There is however a most encouraging growth of interest in air pollution in South Wales, and it is hoped in the near future to convene a special conference in the district to consider the establishment of either a sub-Divisional Council or similar group. To begin with, the local authorities in the area are being sounded, and it is encouraging to read the views of Mr. G. A. Morgan, of Port Talbot, whose recent paper is recorded in part on another page.

Cosy Corner

According to Press reports, Mr. Bellingham, Director of the Coal Utilization Council, has been arguing in a recent speech that the housewife cannot be blamed for smog. The reasoning leading to this conclusion appears to be that there is now less coal being used for domestic purposes than there was pre-war. The *Daily Express* takes Mr. Bellingham to task for what it describes as merely a "cosy opinion," a view we believe most of our members will share. The argument reminds us of the man who sought approbation for the fact that he was now beating his wife fewer times per week. It is of course a fact that there is less domestic smoke than there was, but the reduction is nothing like enough to invalidate any of the indictments that have been made against it. One has only to study the seasonal pollution curves, or to compare suspended impurity on weekdays with that on Sundays to see what sort of a contribution domestic chimneys make. Nor should we overlook the especially noxious *quality* of domestic smoke.

Transatlantic

Our member, Mr. Peter G. Isaac, Lecturer in Civil Engineering, University of Durham, at King's College, Newcastle upon Tyne, has achieved what is probably a unique contribution to the study of air pollution by presenting a paper on "Smoke Aspects of Atmospheric Pollution in America" to a meeting in England on 7th April, and one on "Current Lines of Attack on the Smoke Problem in Britain" at a meeting in Los Angeles on 23rd April! The fact that the author was not present in person at the latter meeting in no way lessens the merit of his interesting double. The paper on Britain was to the American Industrial Hygiene Association; that on the U.S.A. to the Northern Counties Association of the Institution of Civil Engineers.

Personal

Dr. R. Lessing, a Vice-President and Chairman of the Society's Technical Committee, has been appointed as the representative of the Royal Institution upon the Chadwick Trust.

Dr. W. Idris Jones, Director General of Research to the National Coal Board, has been elected to succeed Dr. G. E. Foxwell as President of the Institute of Fuel for the 1953-54 session.

Strictly Without Comment

A cloth cosh stuffed with nutty slack was shown at a Nottingham court yesterday.—*News item, 14th April, 1953.*

THE GREAT FOG

Comment and Correspondence

The Survey published in our last issue, which brought together all the most important information available on the different aspects of the London fog of last December, has been widely quoted and appreciated. Copies of the journal were sent to members of the Government and to all M.P.s, and to meet many requests a reprint of the article itself has been prepared, copies of which are available at 6d. each or 5s. per dozen.

Little new factual information is at present available—though we believe that on the medical side there will be evidence of great interest in due course—but there is much discussion about the disaster and we print below some answers to questions that have been put to us, together with the record of the experience of a well-known member of the Society, and a short selection of extracts from the numerous Press comments and reports that have come in from all parts of the world.

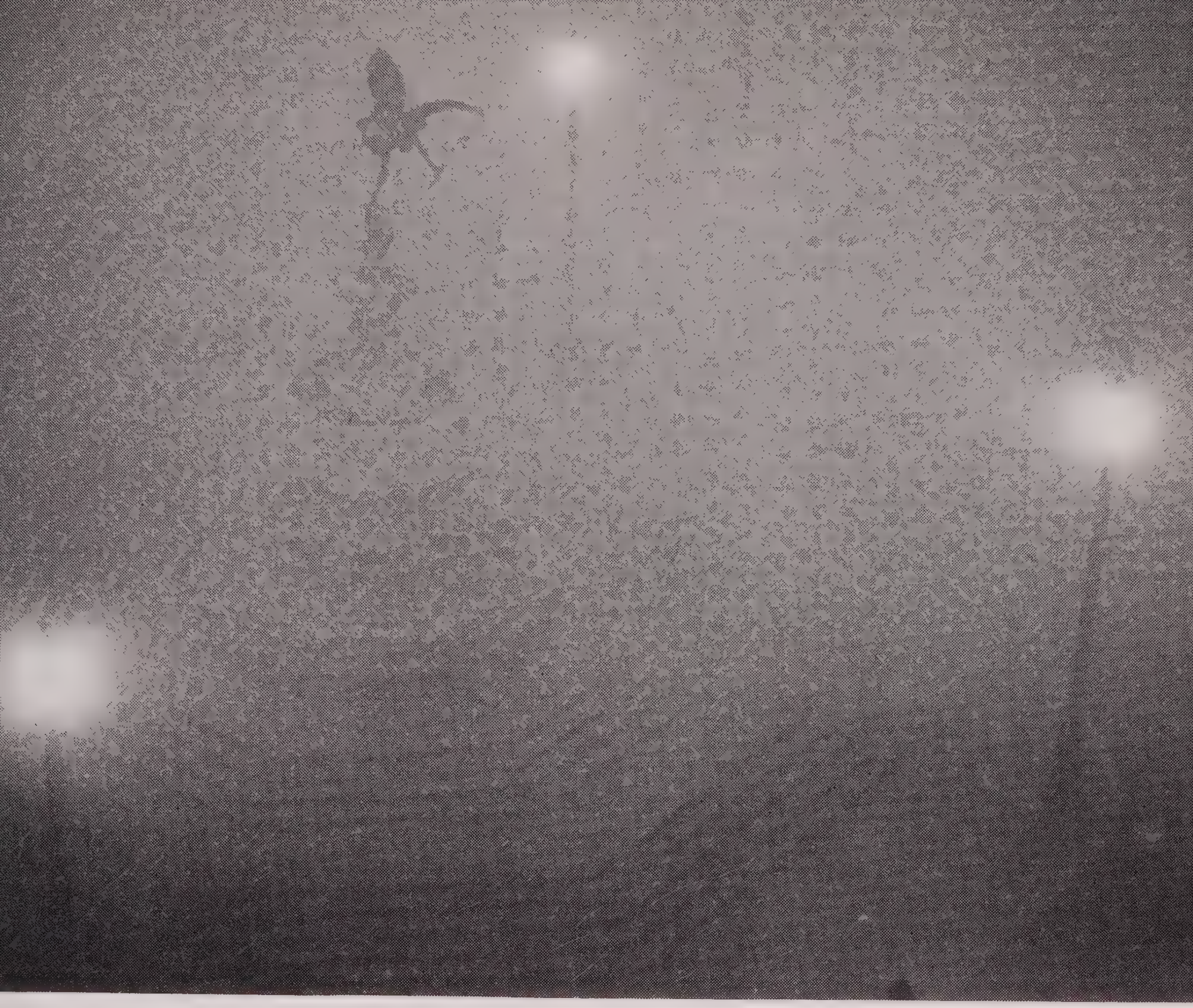
Some Questions on the Fog

Over and above the many thoughtful views on the fog there has been, understandably, a crop of odd theories and improbable rumours. It may be worthwhile to attempt to answer a few of the questions we have been asked or have heard—bearing in mind that some of the most important questions cannot be fully answered until more of the medical evidence is forthcoming.

Were the fog effects caused by some new or special industrial or armament process? If any such process existed its effects, both normally and during such a fog, would be most evident in the locality concerned. The harmful effects of the fog, as shown by the mortality figures, were however, fairly evenly distributed over the whole of the 700 square miles of the Greater London area. This does not mean that exceptional local influences may not have intensified the *general* action of the fog in certain localities.

Could the effects have been caused by radioactivity? There are always radioactive particles in the atmosphere (see abstract on another page) but it is unlikely that there could have been any concentration of such particles during the fog to any significant extent. The idea of a drift of radioactive or any other matter over London from afar is untenable—one of the basic facts of the disaster was the complete absence of atmospheric drift or wind.

Can fluorine be regarded as a factor? Attempts to focus attention on fluorine and its compounds as a factor are being made by propagandists who show no other interest or sympathy with the prevention of air pollution but happen to be opposing proposals made in medical circles for adding small quantities of fluoride salts to drinking water for dental purposes! The effects of hydrofluoric acid emissions from industrial processes using fluorine-bearing materials are familiar and have been the subject of a report of the Medical Research Council (see *Smokeless Air*, 69, Spring 1949, p. 49). There are no such processes in London, or none of any size, and if hydrofluoric acid were a material factor it would have to be that derived from the very small quantity of fluorine that may be present in coal (up to 0.01 per cent.). It should therefore be considered with, and in the same way as, other possible quantitatively minor and trace constituents of chimney emissions which may have toxic effects. Prima facie,



"Fog in the London Area"

We feel privileged in reproducing this fine study, by G. MacDomnic, A.I.B.P., which was included in the recent Exhibition of Professional Photography in London, where it received an Award of Merit as one of the three pictures of the year. Its simplicity of composition and the feeling of the desolation and silence of fog that it so subtly portrays make it an outstanding example of modern photographic art.

however, its effects would be completely overshadowed by those of hydrochloric acid, which in turn is overshadowed by those of sulphurous and sulphuric acids. One of the first noticeable effects of hydrofluoric acid in the atmosphere is its unique etching effect on glass; of which no report in the London area has, as far as we know, at any time been made.

Could any of the new types of domestic appliance have caused the unusual effects? No more than any other kind. The overnight burning of bituminous coal, and particularly slack, on modern grates is creating a new trend towards the build-up of smoke fog, and should be discouraged. The design of such appliances cannot affect in any material way the composition of the smoke and gases passing into the atmosphere.

Is the growth of road traffic, and especially diesel-driven vehicles, a possible factor? It is a possibility that should be studied, although as fog becomes denser road traffic diminishes and may cease altogether. Among the emissions that might have some influence are carbon monoxide from petrol vehicles and hydrocarbons from diesel exhausts. However, if these had any material influence it does not seem probable that it would be more than a small addition to the effects of the major agents.

Is it true that the fog killed only the old and infirm—more bluntly, those who *were likely to die soon in any case*? It seems to be widely thought that this is the case, but it is not true. Examination of the figures and charts in the last issue shows quite clearly that deaths attributable to the fog occurred among infants and in the age groups from 25 upwards. Mortality was certainly higher in the older age groups—from about 45!—but this rise was only in the same ratio as the normal rise. It may be surmised that people with less healthy respiratory systems would be most affected, but such people may have been only temporarily unhealthy or might, normally, have been able to enjoy many years of happy and useful life.

Is such a fog likely to occur again?

The answer, unhesitatingly, is " yes." We do not, however, know when. It may be next winter or it may not be for fifty years. There are more chances of less severe fogs, but always an outside chance of one even worse. The one factor over which we have no control is the meteorological system that sets up a dense and persistent fog, which is held down and confined almost as if it were under a vast inverted bowl or saucer. It can happen over London again, or over some other great centre of population and industry. Whether such a fog would have the same disastrous effect depends of course on what we pour into it.

Can an emergency scheme be prepared to prevent a heavy fog becoming lethal? This is a question many people have asked and which, before it can be answered, requires much study of the many factors involved. It is a major question of the kind the new Government Committee might wish to look into. Ideally, during a dense fog which showed no signs of drift or clearance all solid fuel combustion in the affected area should be stopped, road transport (if any was still moving) halted, power stations and gas works closed down, and all heat and power requirements brought in from outside the area by gas or electric grid. The needs have only to be stated thus to make it obvious that any really practical scheme would require a major effort of organization and legislation. This prompts us to ask the question: should such an effort be demanded?

Sulphur Dioxide

To the Editor:

I have perused the current copy of *Smokeless Air* with interest, particularly those parts dealing with the London fog disaster, but it seems to me that we should try to collect some information as to the constituents of fog which are responsible for respiratory trouble.

I think in the first instance it should be recognized that human beings and animals vary considerably in their respective toleration of sulphur dioxide or other deleterious gases, but even so, I do not think that a matter of 1.3 parts per million of sulphur dioxide can be assumed to be very deleterious, and I think it would be most useful if we could persuade physiologists and medical men to discover exactly which are the constituents which are deleterious.

Yours, &c.,
THOMAS McLACHLAN

London, W.1.

A Personal Experience

To the Editor:

Congratulations on your Spring issue with the details relating to London's disaster last December.

Judging from press and magazine reports, more notice seems to have been taken of the death of thirteen prize cattle in prime condition, until the fog smothered them, and to the damage done to plants and foliage at Kew than to the death of over 4,000 citizens directly attributed to the disastrous fog.

Perhaps a personal experience may interest your readers. It so happened that I had to attend a dinner in town on the night of Friday, 5th December. I left my office shortly after 6 p.m. and walking up Park Lane I found the fog swirling around me in patches thick enough to prevent me seeing clearly anything five or six yards away, and I could not see across the road. Curiously the air was clear from ground level to a height of about 3ft. but above this it was thick fog.

Cars and buses were crawling along in low gear and in the clear air space near the ground I could see the exhausts discharging their quota of deadly fumes, while I could sniff sulphurous fumes in the air. What a beastly concentration of carbon monoxide from the cars, sulphur dioxide from the power stations and combined soot and fumes from the inefficiently burnt coal from London's millions of reeking lums; so I reflected as I strolled unsuspectingly up Park Lane to my destination. Unsuspecting, since I had been in good health for ten years past and felt perfectly fit.

Fog and fumes penetrated the large dining hall in the hotel that night. Still I did not worry but put it down largely to the big company (1,500 guests) and the smoking of pipes, cigars, etc.

I stayed in town that night and on the 6th of December left town about 10 a.m. to go home for the week-end. Again a foggy morning, I was delayed at the station for half an hour. Still unsuspecting I reached home and lazed for the rest of the day, as I just did not feel energetic, but not until Sunday,, the 7th December, did I realize that the fog had me in its grip, and I perforce had to stay in bed for the next fortnight with a bad attack of bronchitis.

But a fortnight did not finish it. I had a nasty and unusual type of cough, and though I was out and about again at the end of a fortnight I felt lethargic and the beastly cough persisted night and morning and not until the middle of March, *three months later*, did I throw it off and feel fit once again.

I frankly admit I got a fright! My doctor warned me, if I saw thick fog again on going into town, to turn and go back to the country again immediately.

In 1945 the cost of atmospheric pollution was assessed by the D.S.I.R. at over £26 million p.a., and the opinion expressed that the real cost was probably double. Today with the change in values of money, we can double that again, say over £2 per year per person or £8 to £10 per household per year. This is exclusive of the costs of ill health and deaths due to this cause. The London disaster, allowing a capital value of £1,000 per person, cost London people over £4 million in addition, while sickness probably cost as much again.

In addition, we are spending, as a nation, over 10 per cent. of our annual income on fuel and power and the average inefficiency is appalling. Still more so is the waste of human life and disease directly due to that inefficiency. Health services cost the nation over £400 million p.a. Is not it high time we thought more of prevention and less of cure!

Yours, etc.,

DONALD V. H. SMITH

Harpenden, Herts.

Fog Cuttings

Murder by Fog

Not even a dark disaster of the magnitude of the London fog last December is without its benefits. It has done for the cause of smoke abatement what months and even years of propaganda work could not do. The wastefulness of fog, its cost in human life and its cost to the country in terms of money were compressed into four weary days. The effect was dramatic. . . . The Smoke Abatement Society speaks with some impatience of the " comparative unconcern " about the occurrence. It is true that we are not nearly as concerned as we ought to be in this country about smoke pollution; all the same, the December fog did give a real shock to public complacency.

Bolton Evening News.

Fog Goes a Long Way

Immediately after the arrival of the *Port Phillip* at Port Chalmers last Monday crew members began working over the side of the ship washing off the effects of a London fog experienced in December, when the vessel was loading for New Zealand. The fog, combined with smoke from the busy metropolis, formed a greasy layer over all it came into contact with,

Otago Daily Times, N.Z.

Act of Man

Reporting to the City of London Corporation Dr. C. F. White, M.O.H., pointed out that such disastrous incidents as the fog in December, 1952, are fortunately rare simply because the special atmospheric conditions necessary to draw attention so dramatically to the results of atmospheric pollution occur only occasionally. He continued: " Atmospheric conditions are act of God, but atmospheric pollution is act of man. For a time there is public interest and even alarm and everybody says that something must be done about it, but the public memory is short and some other disaster steals the headlines. So we relapse into toleration of a normal degree of atmospheric pollution which year after year costs the nation millions of pounds in ill-health and in deterioration of materials of all kinds. We all deplore the smoke emitted from the chimneys, industrial or domestic, of our neighbours, but the little bit that comes from our own chimneys can't really make an appreciable difference, and, of course, we must have a nice, cosy open fire at home and if our factory chimneys smoke, well, what can you expect with the muck we get to burn—and the price it is too."

Medical Officer.

Our Vital Cause

For more than fifty years the National Smoke Abatement Society and its predecessors have fought the pollution of air in Britain. In the great fog last December we had another warning of how vital their cause is, and how far we still have to go before the menace is defeated. . . . The great importance of this matter is that it is not just a " London Particular " as Dickens called it. Although some of the worst fogs occur in the Thames Valley the problem is a national one. We are apt to forget the choking unpleasantness of the fogs and the toll of human life and endeavour in the spring that follows, but the threat must not be forgotten; it must be fought with every means in our power.—*From a syndicated editorial published in numerous provincial papers.*

What Australia Reads

London's glittering formal reception to the Commonwealth Prime Ministers on Friday night in the romantic Guildhall, took place just in time. It was a great success. Had it been held an hour or two later it would have been a major fiasco for the last of the sleek ambassadorial limousines had scarcely left the Guildhall before the worst fog in living memory came down to blot out the whole of London for three days.

With transport in chaos and all the life of the world's biggest city brought to a complete standstill, business losses alone in the 72 hours of strange black silence amounted to something like £6 million. Housewives were rather more concerned with the thick layer of greasy soot deposited in fog-filled flats, on furniture and linen.

Everybody else had enough to worry about with tens of thousands of cars abandoned along the roads, cosh gangs operating with impunity in the all-concealing gloom. Men, women and children were suffering from sore throats, streaming eyes and lungs full of coal-dust.

The Smoke Abatement Society naturally had a field day rolling out sequence after sequence of frightening statistics but there was no sign that

London would take any notice of them.

The fog began to seep into the bombed-out rooms of the Guildhall just when the Commonwealth reception was at its height. Menzies, red-faced and beaming but with eyes already bloodshot by the insidious fog, continued to hold urbane court in the middle of a crowd of richly gowned and diamonded women. . . . The discreetly smiling face of Rab Butler, Chancellor of the Exchequer—the face of a diffident and bewildered intellectual—swayed from side to side bashfully and then swayed away, disappearing into the fog still smiling for all the world like the Cheshire cat in Alice in Wonderland. . . ."

London Diary, Sydney Sun

Credit Note

The London episode has not been investigated, and only recently, notably through the columns of *The Times* and the *Observer*, and in a penetrating analysis in *Smokeless Air*, the journal of the National Smoke Abatement Society, has it been brought into its proper perspective.—*Gas Journal.*

THE DIVISIONS

The recent activities of the Society's Divisional Councils deserve reporting at greater length than that available. The **Yorkshire Division** met in Leeds on 30th January for the purpose of discussing the address given to them by Mr. Arnold Marsh in December (reported in our last issue). The meeting was well attended and there was a lengthy discussion made all the more interesting by the fact that it ranged over a wider field than did the address which provoked it. The meeting closed with a showing of the film " Pictures in the Fire," which so convincingly states the case for improved methods of domestic fuel usage.

On 12th March the **East Midlands Division** met at the works of the Staveley Iron and Chemical Company, Ltd., Staveley, near Chesterfield. A tour of the works was made in the morning—one party to see the foundry and newly constructed baths, and another to inspect the furnaces, coke-ovens and by-products plant. Lunch, in the staff canteen, was taken by invitation of the Managing Director of the Company, Mr. S. W. Martin.

During the afternoon the visitors were given an address on the activities of the Company, by Dr. R. V. Riley, Research Manager, after which tea was served.

The **North West Division** met in Liverpool on 20th March, for a meeting at which the principal speaker was Dr. A. B. Semple, who had just succeeded Dr. W. M. Frazer as Medical Officer of Health for the City. It was in fact Dr. Semple's first public speech in his new office. The subject was " Domestic Smoke Pollution," and a thoughtful, comprehensive paper covered its many aspects in an admirable way. Dr. Semple summed up the remedies for smoke from open domestic fires as follows:

(*a*) solid smokeless fuels of the semi-coke type, so far as supplies are available; (*b*) the installation of solid smokeless fuel burning appliances to burn only coke or anthracite, so far as is possible in individual modern and new houses; (*c*) provision of adequate supplies of coke for all users of these appliances; (*d*) education of the people into all aspects of proper fuel utilization; (*e*) increased fuel storage facilities; (*f*) steps by local authorities to encourage smokeless fuels only to be used in Corporation dwellings.

A report of a **West Midlands Division** meeting is given on another page.

The successful two-day conference of the **Scottish Division,** held at Galashiels as this issue was printing, will be reported in the Autumn number.

The Boiler Operators' Certificate

An Important New Scheme

Sydney N. Duguid, B.Sc.Tech., F.Inst.F., F.R.San.I.
(*Chairman of the Executive Council*)

Since the early days of its existence our Society has advocated improvement in training, qualifications, and status of the men who stoke and tend industrial boiler plant and furnaces. We believe that more skilful and understanding stoking means more efficient combustion and consequently prevention of smoke and saving of fuel. We therefore welcome with great pleasure the long stride forward which has just been taken in these matters and which, we believe, brings our ultimate goal of registration of all boiler firemen appreciably nearer.

It may be remembered that a sub-committee of our Technical Committee went very thoroughly into the question of the education and certification of boiler operators some years ago, and in 1950 proposals were sent to the City and Guilds of London Institute, so we may justly claim that our Society has played an important part in bringing this matter to a successful conclusion.

Now, as the result of work done by an Advisory Committee of the Institute, on which the Ministry of Fuel and Power, the National Coal Board, the British Electricity Authority, our own Society, and other bodies are represented, the City and Guilds of London Institute has established an entirely new course and examination for stokers which will enable them to obtain the "Boiler Operators' Certificate," which in effect is a national certificate for proficiency and one that will be recognized in every part of the country.

The examination, held by the City and Guilds of London Institute, will comprise a Written Paper and a Practical-Oral test. The written Paper will be of three hours duration and made up as follows:

Section A: comprising a number of questions calling for very short answers. The questions will range over the syllabus as a whole, and the degree

of choice will be restricted.

Section B: comprising questions of normal type. Some of the questions may relate to specific types of plant, and sufficient choice will be given to permit candidates to relate their answers to their own experience, coupled with the knowledge gained in the course of instruction.

Practical-Oral Test: only candidates who reach a sufficiently high standard in the written paper will be called to the Practical-Oral test. The test will be conducted on the firing floor by local examiners appointed and paid by the City and Guilds of London Institute. A high standard of practical efficiency will be expected.

It is recommended that candidates should have been employed in a boiler house for not less than two years and have received a minimum of 50 hours instruction.

Further details can be obtained from the City and Guilds of London Institute, Department of Technology, 31, Brechin Place, South Kensington, London, S.W.7. The syllabus is given below.

It is hoped that courses for this examination will be set up in all industrial areas. We appeal to all our members and associates to make the Certificate known as quickly as possible and to assist, in every way they can, the establishment of classes in their area. We would especially ask those who have been disappointed with the results of their efforts in time past, to try again, as now that the Boiler Operator has something definite for which to work, we feel confident that a much greater demand for instruction of this kind can be expected.

SYLLABUS

Steam Generation: Elementary ideas on heat, temperature, and pressure. The conversion of water to steam. Sensible heat, latent heat and total heat. The meaning of saturated steam and superheated steam. Importance of dry steam. Boiler priming.

Fuels: Elementary composition of common fuels. The sampling of solid and liquid fuels. Proximate analysis and heating value. Coal grading and its effects. Ash tests.

Combustion: Elementary principles of fuel combustion. Conditions necessary for complete combustion. Primary and secondary air. Preheated air. Composition of flue gases. Waste due to incorrect combustion. Smoke and dust emission. Effects of these emissions in town and country areas. Methods of smoke and dust reduction. Wetting of coal and its effects.

Heat Transmission: Radiation, conduction and convection. Importance of clean surfaces. Effect of soot, dust and scale on heat transfer.

Boilers: Principal types of shell, smoke-tube and water-tube boilers. Superheaters. Brickwork settings. Flues, ducts and dampers. Importance of insulation. Cleanliness of boilers and flues. Fittings and mountings.

Draught: Natural, induced and forced draught systems. Conditions affecting draught. Damper control methods. Practical use of primary, secondary and preheated air systems.

Firing Methods: Basic principles of good stoking. Hand firing methods. Tools and cleaning of fires. Mechanical stoking. Principal types of mechanical stoker. Simple treatment of pulverized-fuel firing. Oil firing principles.

Boiler Auxiliaries: Pumps and injectors. Feed-water heaters. Feed-water regulators. Economizers. Air heaters. Fans. Soot blowers. Dust and grit arrestors. Coal handling plant. Ash-handling plant.

Feed Water: Importance of good feed water. Simple treatment of water by softening. Density and blow-down. Use of condensate. Make-up water. Effect of condenser leakage and oil contamination.

Boiler House Instruments: The practical use of draught gauges. CO_2 instruments. Fuel and steam meters and pyrometers.

Log Records: Importance of daily records of boiler operation. Simple methods of logging such items as fuel, water, steam, draught, CO_2 and temperatures. Recording of smoke emission and use of soot blowers etc. Logging of starting up and shutting down plant.

THE PRACTICAL-ORAL TEST

The candidate will be expected to have an intimate working knowledge of all parts of the boiler plant with which he is familiar, including instruments.

(*concluded page* 158)

"THE TIMES" ON AIR POLLUTION

Two Important Articles

"Polluted Air Over the Towns" was the title of two leader-page articles, by "A Special Correspondent," that were published in *The Times* on 20th and 21st April 1953. The articles, distinguished by a clear analysis and summation of the problem, and an equally clear and thorough indication of the practical remedies required, created much attention and undoubtedly have done a major service in bringing the case for smoke prevention so cogently before a readership that includes those who lead public opinion and initiate public policy. It is to be regretted that the obviously well-informed and authoritative writer should remain unnamed.

The first article dealt with the effects of air pollution, and particularly with the lessons of the London fog. An accompanying chart shows the close similarity of the shape of the curves for the rise and fall of smoke and sulphur dioxide concentration during the foggy period and the shape of that for the rise and fall of deaths. "The causal connection between pollution and mortality in this case," says the author, "is beyond cavil."

"Though this particular fog was admittedly an exceptional occurrence," continues the article, "it is obvious that even under less abnormal conditions the noxious matter in polluted air must have a detrimental effect on human and animal health and comfort; no doubt the effect is less violent, but all the more persistent. Not the least objectionable aspect is the shutting out of the sun's rays in densely populated districts."

The widespread material consequences are noted and "the damage, nuisance, and loss of amenities caused by atmospheric pollution in countless cases have been demonstrated over many years by the National Smoke Abatement Society and its predecessor the Coal Smoke Abatement Society of London."

The writer suggests that the amount of pollution has not changed since the beginning of the century, although its character has. There is less domestic smoke but more flue dust and grit from power stations and other industrial plant, and an increase of course in the total consumption of fuel.

The Remedies and their Cost

In the second article the economic cost of pollution is considered and the author begins by saying "Whatever success may be gained in establishing the fundamental causes of air pollution and in devising technical processes for dealing with it, the test of what can be done is primarily economic. It is by this test that a decision must be made for or against the application on a nation-wide scale of the means of prevention or abatement of this great evil. By and large, the economic problem resolves itself into one simple question. How much damage, expressed in money, is done by the pollution of the atmosphere, and how much would it cost to prevent or repair that damage."

The various factors that make up the economic losses are discussed and it is well pointed out that to express in terms of money the harm done to the health of the population or the value of human life is a still harder task. "If the community had to pay compensation for the 4,000 Londoners who died from the effects of polluted fog in the fatal December week, the bill would amount to several million pounds." It is suggested that the most recent estimate of the cost of pollution, £150 million a year for this country, is probably on the low side.

Four main lines for improvement are proposed, which may be briefly summarized as:

1. Improvement in the all-round efficiency of fuel utilization.

2. Thorough cleaning of coal to prevent polluting matter—particularly sulphur-bearing pyrites and the natural coal dust—from reaching the furnaces.

3. Replacement of house coal by smokeless fuel or burning it in efficient modern grates or stoves. ("The banking of open fires with fine coal, as distinct from ashes, must be discouraged, as it generates smoke and radiates little heat.")

4. The purification of flue gases from both ash and sulphur dioxide in large boiler plants and industrial furnaces.

Power stations and large factories comprise the class most able to bring about a significant cleansing of the atmosphere by the cleaning of their flue gases. The cost of this would be equivalent to an addition of 10 shillings a ton to the price of coal, but there was some force in the argument, continues the article, that one section of the community should not be called upon to bear the cost of preventing damage for the benefit of the whole. If that argument were accepted the problem should be placed on a national basis. The annual bill would run into many millions of pounds but this would be a small price to pay "if it were found that the damage averted was several times the expenditure incurred."

Smokeless zones on an extensive scale are urged, and the article concludes: "Much could no doubt be done by enforcing and tightening up existing legislation. A close study of the financial implications would show whether and to what extent the Exchequer should assume—by tax relief of grants-in-aid—the responsibility for providing the means for preventing pollution of the air. Of the vast damage done by that pollution there is no reasonable doubt."

(*The Society has secured a limited number of reprints of the two articles, copies of which will be sent to members free of charge, on request.*)

District Heating

An informative, factual review of district heating, published in *The School Science Review*, No. 123, March, 1953, has been reprinted in pamphlet form. The author is V. A. Carpenter, M.SC., F.R.I.C., of the City Training College, Sheffield, a member of the Society, whose earlier paper on the Heat Pump was published in a similar way. Mr. Carpenter states the case for district heating objectively and discusses the difficulties it has had to face in this country. Facts and figures about district heating development in the U.S.A. and Europe are given, and for this country attention is devoted mainly to the Pimlico scheme. Of particular interest are maps and statistics showing the extensive growth of district heating in Copenhagen, where the annual load rose from 29,000 million B.Th.U.s in 1925-6, to 671,500 million in 1944-5, and to 1,317,000 million in 1949-50.

Air Repair

The February and May quarterly issues of *Air Repair*, the journal of the Air Pollution Control Association of the U.S.A. reflect the new policy that makes this a publication devoted to the more technical and scientific aspects of the problem. Of particular note in the February issue are articles on "Highway Traffic Contributions to Air Pollution," by L. J. Grunder, and "Industrial Experience in Fly Ash Collection" by B. S. Norling; while in the May issue are contributions on "Atmospheric Pollution and Smoke Control in the Union of South Africa," and a reprint of a paper by George R. Hill on "Anticipating and Preparing Against Possible Industrial Hazards from Air Pollution.

From this last paper it is interesting to note the success obtained by raising the height of the chimney of a smelter furnace (in which sulphide ores are roasted to drive off the sulphur) from 146 to 605 feet. A sulphur dioxide recording apparatus situated 2.6 miles downwind from the smelter recorded SO_2 in excess of 0.5 ppm on 842 occasions during a period of 42 months with the short stack in operation. During the 15 months after the new high stack was installed the SO_2 reached 0.5 ppm on one occasion only. The average concentration fell from 0.057 to 0.025 ppm.

Burnley Meeting

Mr. S. N. Duguid, Chairman of the Executive Council, addressed a joint meeting of the Burnley Smoke Abatement Advisory Committee and the North Western Section of the Institute of Fuel at Burnley on 1st April. He said that the subjects of fuel efficiency and smoke abatement should be a crusade. The cost of coal came into everything and consequently was of paramount importance to everyone. If the price went up the price of everything else went up, and for that reason alone they ought not to waste one cobble or even one grain of slurry if they could put it to good use. If enough coal had been saved to send more abroad during the past few years, the financial position of the country would be very different.

Industrially, there was a growing consciousness of the need for eliminating smoke and although little visible evidence existed of the great strides being made, he felt that within a year or two a great improvement would be brought about. The industrialist should examine his plant, test it and find out where losses were occurring and those would be the pointers that would tell him what action he must take. There was no certain method, no matter what devices were used, and an awful lot of money was wasted on fuel-burning plant of the wrong kind.

Above all was something which he thought was the missing link, and that was the education of the stoker. He wanted to make a violent plea on his behalf, for he was the man who inherited all the inefficiencies of his superiors, had to contend with the most awful boiler plant in some cases and also coal that might or might not be suitable.

At present anyone could pick up a shovel and shovel coal into a boiler, and he was told that this was the only civilized country where this was allowed. If we were to survive as a nation there must be co-operation on this question. The strength of a chain was in the weakest link, and the weakest link in the boiler house was the fireman.

Fairlop Airfield Rejected

The Minister of Transport and Civil Aviation has decided that Fairlop airfield, Essex, shall not be a permanent airport. One of the principal reasons, given in a memorandum to the Court of Common Council of the City of London, is that "In the prevailing wind conditions Fairlop is in the track of the industrial haze and smoke of London, and even in calm or light wind conditions is close enough to London for the visibility to be affected by industrial haze."

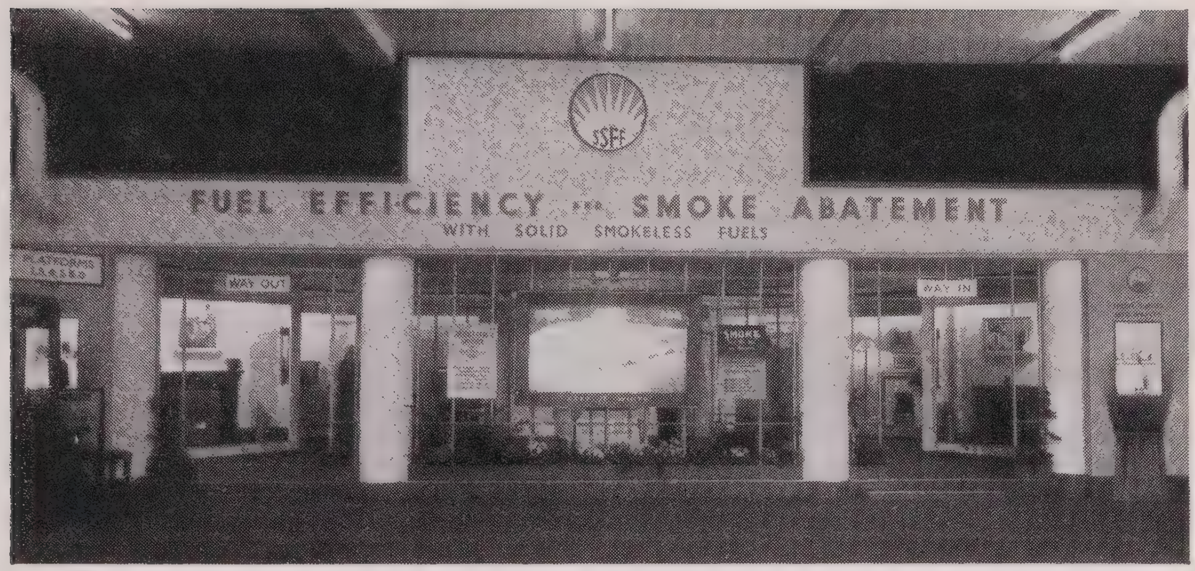
Boiler Operators' Certificate—*concluded*

He should be conversant with the method of starting up, banking and shutting down a boiler.

Oral questions on the subject of maintenance will be asked.

In addition, the candidate will be expected to have a working knowledge of pumps, feed water storage and treatment, economizers and draught fans.

Only those candidates who pass the written paper or who are on the borderline between pass and fail in the written work, will be summoned to the Practical-Oral test.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FUEL EFFICIENCY AND SMOKE ABATEMENT
WITH SOLID SMOKELESS FUELS
WAY OUT
WAY IN

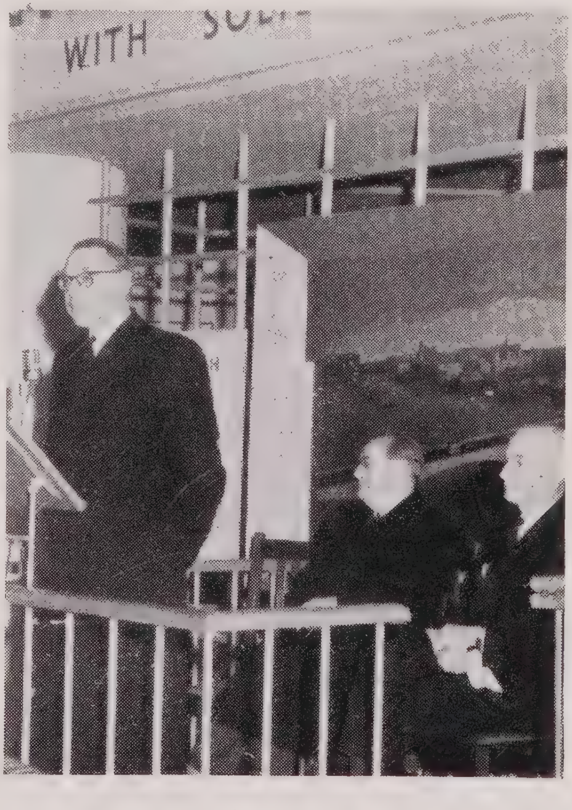
A NOTABLE EXHIBITION

The Solid Smokeless Fuels Federation is to be congratulated on the effectiveness and success of the exhibition it arranged and staged in the entrance hall of the Charing Cross Underground Station from 7th to 25th April, 1953. It was on the same site that a smoke abatement exhibition was held, under the auspices of the Society, by the Gas Light and Coke Company in 1938.

" Fuel Efficiency and Smoke Abatement " was the theme of the exhibition which broadly demonstrated the better standards of heating and comfort in the home that are made possible by solid smokeless fuels in modern appliances. The fuels and appliances were displayed, some of the fires and stoves being in operation, together with other informative material and a section on the smoke problem itself—in the planning of which the Society had been pleased to co-operate. Some of the Society's literature was on sale and many copies of a new edition of its leaflet " Facts about Smoke " were taken by visitors, of whom there were nearly 3,000 a day.

Insulation and the need for good fuel storage were also demonstrated, and there was a display showing the heating efficiency of the solid smokeless fuel compared with that of ordinary coal on various appliances. The research work and testing of fuels and appliances in the laboratories maintained by the members of the Federation were also illustrated.

There was an official visit to the Exhibition on 15th April by the Hon. L. W. Joynson-Hicks, M.P., Parliamentary Secretary, Ministry of Fuel



Mr. Joynson-Hicks, M.P., Lord Latham and Mr. Henry Jones at the Exhibition

A smoke abatement section of the exhibition. Note the question " Why not a Smokeless Zone in Central London? "

and Power, and other distinguished visitors. At a short ceremony Mr. Joynson-Hicks was introduced by Lord Latham, Chairman of the London Transport Executive.

In his speech Mr. Joynson-Hicks said:

" Day after day throughout this long winter the Underground Railways have been bringing into Central London tens of thousands of people to work. When they have left the outskirts of London the skies have often been clear and the sun shining, but when they get into London they have, time and again, found the sun hidden by a foggy blight. We want to put an end to these fogs. Smoke from the chimneys is one indication of the inefficient burning of fuel.

" Already the Government are setting up a special Committee to enquire into the more technical aspects of smoke abatement, but each one of us can help in the matter ourselves by preventing our fires from smoking.

" The Government are also doing much to help. Coalite is a smokeless fuel and is now ' off the ration ' and the allocation of coke was greatly increased this winter and all modern fireplaces which are ' improved appliances ' must be capable of burning coke. Over 2 million of them were produced last year. If people will burn more coke in their domestic fires they will help us to achieve the dual object of reducing the smoke which goes up the chimney and using fuel more efficiently."

Mr. Henry Jones, Chairman of the Federation expressed his thanks to Mr. Joynson-Hicks and to Lord Latham for allowing them the use of the premises.

The S.S.F.F. comprises the producers of 34 million tons of smokeless fuels per annum, namely; Gas Coke, Hard Coke, Anthracite, Welsh Dry Steam Coal, Phurnacite, Coalite and Rexco—virtually all the solid smokeless fuels produced in Great Britain.

Air Pollution in South Wales

Towards a Remedy

From a Paper by G. A. Morgan, F.R.San.I., F.S.I.A.

One of a series of lectures arranged by the Glamorgan County Council and the Sanitary Inspectors' Association at Bridgend on 15th and 22nd April was a paper on Atmospheric Pollution by Mr. Morgan, who is Chief Sanitary Inspector, Port Talbot. This was a comprehensive review of the subject, with particular reference to problems in South Wales, and space permits only the reporting of the final section—"Towards a Remedy." Apart from the interest of its contents, we are glad to be able to publish this, as the Society is at the present time exploring the question of holding a special South Wales conference, with a view to setting up a Division or similar organization in the area, as Mr. Morgan suggests. The views of readers in South Wales will be welcomed.

Sufficient has already been said in this address to indicate that we could be badly disillusioned if we depended on the law and legal proceedings in an attempt to bring about a solution of the problem of atmospheric pollution. I feel that the present state of the law is not only inadequate but makes an entirely wrong approach to the problem. Prevention rather than cure should be the aim of our legislators.

There are, in fact, a number of separate and largely dissimilar smoke problems, which demand from the technical viewpoint, different remedies. There is no single simple panacea, such as universal electrification or the overall prohibition of the burning of raw coal. Nor is it helpful to advocate action that is not technically or economically sound. It is only at the administrative level, where the adoption of different means for smoke prevention can be enforced, that the several sources of pollution come together as a single problem. Smoke pollution does not respect local authority boundaries. At one time there were heated arguments between Manchester and her neighbour Salford over the smoke nuisance in the area of the river separating both towns—each side saw the nuisance on the other side of the river.

Many remedial measures are being suggested and indeed some are being realized. Many of our larger towns and cities are establishing smokeless zones. Amongst these are Manchester, Coventry, Rochdale, Bradford, Bolton, Urmston, Crewe, Wolverhampton, Edinburgh, Sunderland, Swindon, Tottenham and Preston. It is suggested that our new towns should be made smokeless from the very commencement. It is suggested that tenancy agreements and leases should contain clauses providing for higher-efficiency domestic fuel burning appliances. As far as domestic appliances are concerned, the principle appears already to have been accepted by the Government, which has approved the main conclusions of the Domestic Fuel Policy Report. This firmly recommended: "That the manufacture and sale of new appliances falling below approved standards should be prohibited as soon as possible (and that) the Government should take steps to secure the mass production of standardized domestic fuel appliances."

The Glamorgan County Act now providing for the purchase and sale of land gives an opportunity for the incorporation in leases of land which it may sell, of a clause to control the emission of smoke from any buildings or works erected thereon.

It has been suggested that the training and registration of stokers and firemen would be a substantial contribution towards the reduction of atmospheric pollution and that a scheme of prior approval by local authorities of all works' installations should be introduced so as to secure as far as practicable that only a minimum of smoke be emitted. One or two private acts already provide for such prior approval. In one special field this prior approval is already exercised in this country—chemical works and other processes scheduled under the Alkali Etc., Act.

It has also been suggested that the burning of raw coal in domestic grates should be prohibited and that the burning of bituminous coals should be under licence; the introduction of schemes of central heating for large buildings or blocks of flats: the substitution of coal by gas and electricity for heating purposes; general licensing measures for the control of the use of fuel rather than the control of smoke emission.

It is unfortunately true that many local authorities, on one hand, know they suffer from the effects of pollution and accept the fact as a necessary evil as a result of the industrial nature of the district, whilst on the other hand, some authorities feel that because they have no industries they have no pollution problems. Having regard to the facts presented in my paper, it will be appreciated, however, that such an approach to the problem is unfortunate and also fallacious. There is much, however, that can be done at local level to further the case of a clean atmosphere. For example, there are still too many Councils who are doing nothing to assist the Fuel Research Station in compiling data regarding the polluted atmosphere of their districts. It would be a tremendous stride forward if the whole of the South Wales Authorities were to undertake the recording of atmospheric pollution in their respective areas and build up a comprehensive record of the condition of the air in the South Wales area. Records of atmospheric impurity will provide effectual data in support of claims for better atmospheric conditions. Other methods to build up a case are out of date and unreliable. The records secured at Port Talbot have already been very useful in convincing local industry of the damaging effects of industrial pollution, and we feel, have been far more effective than countless argument in bringing about the desired results.

Local Authorities can secure the installation in all their houses of nothing but solid fuel appliances recommended for domestic use by the Ministry of Health. These appliances are capable of burning smokeless fuel or ordinary bituminous coal.

Local Authorities could promote local acts for smokeless zones; and as already indicated, authorities could insert smoke prevention clauses when leases are being drawn up for the development of industrial concerns on land under their control. Although we may be disillusioned by the ineffectual and frustrating legislative support given to local authorities in their attempt to deal effectively with the smoke problem, local authorities could still do much to secure the interest and goodwill of industry, and to produce an enlightened and interested public opinion, focused upon the evil effects of atmospheric pollution and the need of a clean atmosphere.

There are many separate smoke problems often demanding different remedies. I have already indicated that atmospheric pollution is not a respector of municipal boundaries. I am satisfied that some of the pollution produced at Port Talbot affects the adjoining areas of Maesteg, Glyngorrwg and Penybont and this applies equally to all the other industrial towns in the South Wales coastal belt. The polluted air from these towns is carried inland to the urban and rural areas. There is also the need for promotion of more effective legislation having a realistic and practical approach to the problems so far unsolved, but which are capable of solution if demanded.

It is obvious, therefore, that the most effective remedy lies in the realm of co-ordinated action by the joint activity of a number of local authorities or by a committee or board composed of representatives of local authorities and other interested bodies, technicians and industrialists.

An initial step could be for every South Wales authority to become members of the National Smoke Abatement Society. This Society has done really good work towards the promotion of a clean atmosphere. In its efforts to further the cause of smoke prevention, it has been handicapped by the inadequate support it has received. I am indebted to the indefatigable General Secretary of this Society for some of the information I have been allowed to include in this address. Before the war, the Ministry of Health was concerned with the legislation controlling smoke emission. (These powers were transferred to the Ministry of Housing and Local Government in 1951). The authorities concerned in the administration of smoke abatement legislation were, of course, county and municipal boroughs, urban and rural districts, and in London, the London County Council. During the war years the Ministry of Fuel and Power exercised a measure of control in an effort to save fuel during a period of fuel crises and made a definite contribution, not so much because it was interested in a clean atmosphere, but because the emission of smoke indicated gross wastage of a valuable national asset—coal. I am indeed very appreciative for the happy relationship and the co-operation that I have received from the officials of this department in respect of some of my problems at Port Talbot during the post war years. A new form of indirect control is now emerging from the codes of practice—specifications for fuel burning appliances and other methods for raising efficiency standards. This comes under the control of the Ministries of Works and Supply. Closely allied to the work of smoke prevention is fuel research, the measurement of atmospheric pollution and other scientific investigations. All these activities come under the Fuel Research Board which is a section of the Department of Scientific and Industrial Research.

We have, therefore, a Ministry of Housing and Local Government primarily responsible for smoke abatement, with several other departments directly concerned with particular aspects of the problem. There is no formal co-ordination between them and no integration of policy or programme. A more recent development, however, was the setting up of an inter-departmental Committee on domestic heating, comprising representatives of the Ministries of Fuel and Power, Health, Works and Supply. This Committee concerned itself with the problems of production and approval of the new higher efficiency domestic fuel burning appliances to which I have already referred in this address.

On the local authority administrative side conditions vary, as might have been expected, between the excellent and the non-existent. Within the narrow limits set by the present law, smoke abatement work in some towns, generally the larger ones, is admirable. In some areas, on the other hand, smoke abatement is virtually a dead letter. It is obvious, therefore, that with the many interests involved, the lack of unified action, and the varying methods of approach, control on a regional basis appears to be the only effective method towards a solution of this problem.

There are already, I understand, Advisory Regional Committees of local authorities in Northumberland and Durham, West Riding of Yorkshire, Manchester and District, West Lancashire and Cheshire, Midlands, Bristol and District and in the Greater London area. The Committee covering the Sheffield, Rotherham and District area functions with statutory authority. The others are endeavouring gradually to acquire statutory functions. In the areas where Regional Advisory Committees have been set up, each local authority still performs its duties separately, mutual help, advice and encouragement being made available through meetings of these Advisory Committees.

I feel that the first step would be for all South Wales Authorities to become members of the National Smoke Abatement Society. We could, therefore, secure the valuable guidance and advice of this Society. The National Smoke Abatement Society has done much to focus public opinion on the subject. It holds conferences and publishes reports. It carries out investigations and acts as a national centre for information, inquiries and other services. It has divisions in most parts of the country. If a sufficient number of South Wales authorities become members, a division could be set up in South Wales and we would, therefore, secure the valuable guidance and advice of this Society.

The next step would be to set up a Board or Committee representative of constituent authorities, representatives of Government Departments, the Welsh University, technical, scientific and industrial interests. If the whole of the South Wales Authorities were not prepared to be represented on such a Board, at least the geographical County of Glamorgan or the industrial belt from Newport to Llanelly should join up to form such a Regional Advisory Committee.

The formation of such Committees would not take out of the hands of local authorities any of the powers they already possess, but would provide for the uniformity of application of such powers over a greater area, assisted by technical and scientific officers that would be at the disposal of the Committee. The industrial and technical members of such a Committee would ensure the interest and goodwill of industry in the area and the representatives of Government Departments would help to provide for the necessary co-ordination of administrative action.

The delivery of this address will be of no avail unless it succeeds in stimulating interest in this important problem of smoke abatement. I have deliberately set out to focus attention on the need for uniformity of action along the South Wales coastline. Having prominent members of the Glamorgan County Council present, I hope that this address will encourage them to influence this very important county authority to consider the calling of a conference of County districts and other areas and bodies to discuss the advisability of the formation of such a Committee as I have suggested.

SMOKE HAZE OVER THE ISLE OF MAN

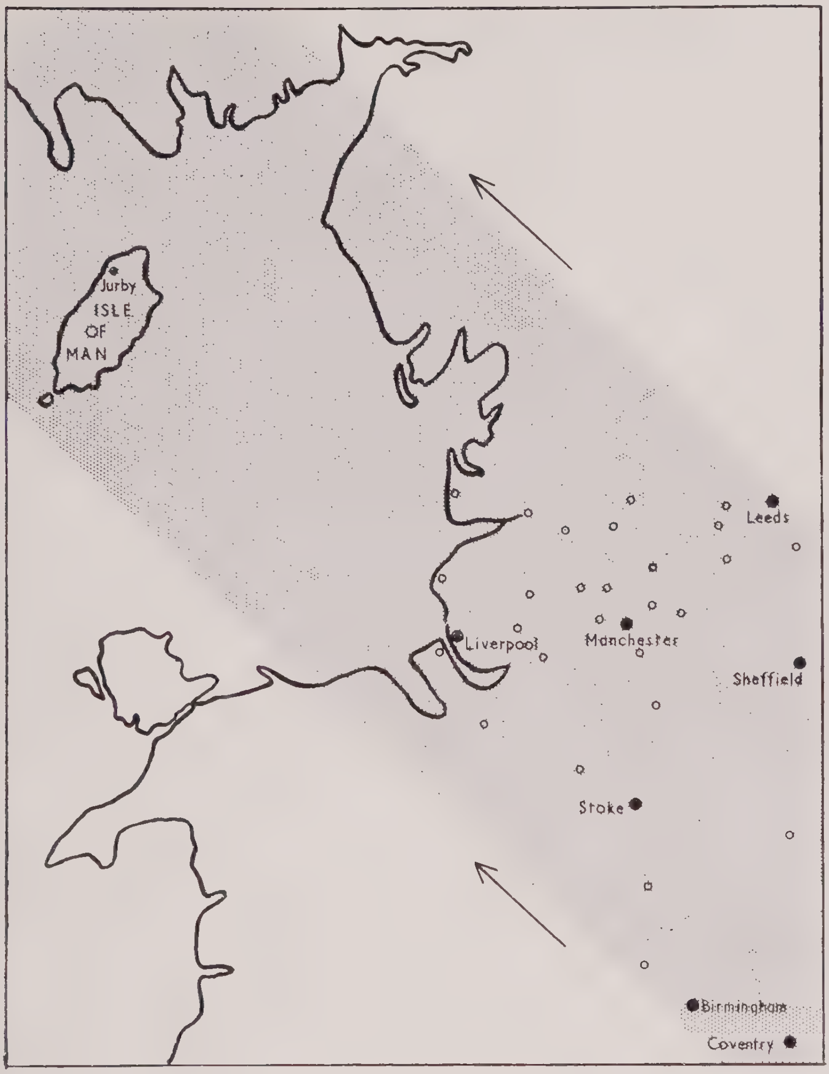
By K. C. Kearns, B.Sc., F.R.Met.S.

IN the course of my war-time meteorological duties I was stationed for nearly two years at Jurby aerodrome, Isle of Man. During this period I was afforded an excellent opportunity of observing the effects of smoke haze on the visibility of an island which, situated as it is, not less than 100 miles from the industrial areas of the Mersey Basin and the Midlands, might have been thought " safe " from all except the slightest effects of pollution.

Experience showed, however, that this was far from being the case. Not only may the Manx visibility be seriously reduced from this cause, but also such deteriorations occur with fair frequency, and more than would be suspected from a casual examination of the possibilities. When, further, it is remembered that haze affects the vertical as well as the horizontal visibility, the importance of this factor in relation to flying in the Isle of Man area becomes apparent.

The geographical elements involved are simple. The Isle of Man lies roughly N.W. of the great industrial areas of Lancashire—Cheshire and the Midlands, being about 100 miles from the former, 150 miles from the latter. It follows that, whenever the wind sets in the S.E., the smoke haze produced in these areas will be carried out over the Irish Sea, with the liability, at any rate, of it eventually reaching the Isle of Man. All this is straightforward enough, but what impressed me most strongly, and remains vividly in my memory, was the extent of the reduction in visibility caused by the haze, so far from its source, and after all the opportunity for dispersal implicit in such a long journey. At Jurby, as at any island station, it is often possible to see more than 30 miles; the Mull of Galloway, the Cumbrian and Mourne Mountains can at times be observed with startling clarity. Imagine, then, the potency of pollution which can transform air of such crystalline purity into a turbid, yellowish atmosphere of scarcely two miles visibility, an atmosphere only too familiar to those who have perforce to dwell on the periphery of industry. Such was the possibility, which any weather forecaster at Jurby quickly learned to recognize and allow for.

It will thus be understood that, whenever the wind shifts round to S.E., a more or less serious reduction of visibility due to smoke haze must be anticipated in the Manx forecast. Now, although meteorological generalizations are both difficult and dangerous, there are two types of situation which occur with sufficient frequency as to allow them to be broadly categorized. The first comes about with the passage of a series of depressions to the N.W. of the British Isles. In the rear of such depressions there is normally a stream of fresh, cool, polar air, remarkable, inter-alia, for the excellent visibility then prevailing. As the old depression moves away, and the next one approaches an intervening ridge of high pressure crosses the area, and as this takes place the wind moderates and backs steadily from N.W. round to S.E. Here, then, is the crucial point at which perfect visibility may be replaced by translucent haze, and bearing in mind that the oncoming depression will be causing a deterioration in the other elements as well—freshening wind, increasing and lowering cloud, onset of rain or drizzle, it is not difficult to appreciate the cumulative disadvantages inherent in the situation, and the caution exercised by a forecaster in dealing with it.



The Isle of Man and its South-East Smoke-Wind

The reduction of visibility upon the arrival of the smoke haze can be quite abrupt, and may easily be reflected in two successive hourly observations. On one occasion I happened to witness the exact moment, as the haze spread over the airfield from the direction of Ramsey, on the opposite coast. I shall never forget the feeling of aversion induced by the spectacle. I beheld a magnificent island visibility dying before my eyes, the departure of pure marine air, the advent of its turbid industrial successor. On the one hand a glorious 20 miles, on the other a struggling three. At that instant I was assailed by the same feelings which one experiences on seeing muddy water poured needlessly into a transparent rocky pool.

There are one or two cognate points which come to mind before I conclude this article. It is worth noting that the geographical alignment of Great Britain from S.E. to N.W., with the major industrial areas (London, Birmingham, Manchester, Glasgow, etc.), following suit, is such that with a sustained S.E. wind comparatively few parts of our island can escape some degree of haze pollution. Thus our investigation of the phenomenon which was brought so forcibly to our notice in the Isle of Man, has led to a wider and significant conclusion in respect of our whole country. Against a persistent S.E. wind we are practically defenceless, and haze, inimical to health and aesthetic pleasure alike, will all too often defile summer's most precious weather.

Why, then, it may be asked, is this the unenviable prerogative of the S.E. wind? Why are there no comparable incursions of haze with, say, westerly or northerly winds? The answer is to be found in the fact that such winds are almost always convective, and in consequence the haze is distributed quickly, effectively, and three-dimensionally throughout the atmosphere. It is Nature's own ventilation system. We may indeed be thankful that it does not break down more often.

The second type of haze invasion is less frequent but, when it does occur, far more persistent, and is a feature especially of late spring and summer. A strong anticyclone or ridge becomes established over the southern North Sea, or adjacent Continental area, and a warm, stable, S.E. airstream is maintained, perhaps for days on end, over the British Isles. The resultant smoke haze is borne inexorably N.W.-wards, far beyond the Isle of Man, ultimately affecting even the Outer Hebrides, though doubtless reinforced en route by a contribution from Clydeside. In these circumstances visibility, at Tiree or Stornoway, for example, may be reduced to three miles. (Probably this does not sound unduly poor, but three miles is little enough, under haze conditions, for an island or aviation).

With both categories, but particularly the second, there is usually only a small atmospheric lapse rate, and sometimes, in fact, quite a marked inversion of temperature. Hence, in the absence of convection the haze is confined to the lower layers of the atmosphere and thereby prevented from dispersing vertically. It is this factor which accounts for the unexpected thickness of the haze so far from its source.

The Ridley Report: A Critical View

The Ridley Report has been generally welcomed by those concerned with smoke abatement. It is therefore of interest to record the less favourable comment that follows. It is the concluding section of a paper on the Ridley Report read by A. Archer, M.S.I.A., Chief Sanitary Inspector, Halesowen, at a meeting on 26th February, 1953, *of the Midland Joint Advisory Council for the Abatement of Smoke and Atmospheric Pollution.*

Although at the outset the Ridley Committee recognized that to promote the maximum economic efficiency in the use of each fuel, the social cost to the community of producing or using fuel would need to be considered such consideration seems to have been of a very secondary nature. Throughout the report the language used about smoke abatement is cautious and hesitant.

> " The Committee recommend the development of more efficient types of open fire which will burn coal with *less smoke* and *greater efficiency* than the standard of improved fires now coming into popular use."

The tone of the report is concerned with *less* smoke rather than the abolition of smoke.

In the Appendix on Smoke Abatement, measures are set out which in the Committee's own words " should lead to smoke abatement." These measures allow for less smoke production from solid fuel appliances burning coal and for the greater use of coke. Elsewhere in the report (p.36) the Committee express the opinion that there seems no likelihood of a great expansion in the supply of smokeless fuels in the next few years.

It is important to remember this when assessing the value of the Committee's observations that further progress in the establishment of smokeless zones depends on having enough smokeless fuels and appliances available.

A matter worthy of special study and investigation is the change in domestic use pattern. From 1940-1950 the domestic user consumed 11m. tons less raw coal consumption falling from 46 to 35 million tons. This decrease was offset by increased use of coke, gas and electricity. Had such a decrease been brought about by the use of more efficient appliances it would have been hailed as a triumph. But has there been any noticeable improvement in atmospheric conditions?

If there has not been any noticeable improvement, is it any real use to the cause of smoke abatement to develop appliances which merely emit *less* smoke? Or is the effect of industrial pollution much more serious than we are often led to believe?

However efficient domestic appliances are, if raw coal is used in them, they will in general be used inefficiently. The evidence that their use results in any substantial fuel saving is scanty and controversial. If the recommendations of the Ridley Report are accepted without qualification, it is quite possible that the cause of smoke abatement may well be put back many years. The questions we must ask ourselves are:—

(1) is smoke abatement likely to be achieved in the domestic field by the expansion of the programme to produce fires which will burn raw coal with *less* smoke?
(2) were the social costs of atmospheric pollution really appreciated by the Ridley Committee?
(3) is the case for the greater use of electricity, gas and coke more important to the nation than is suggested in the Ridley Report?

These questions and many others which arise, prompt me to suggest the need for a government sponsored Committee on atmospheric pollution where fuel economy will have an important but incidental place.

It must be remembered that the Ridley Committee dealt only superficially with the use of fuel in industry, and not at all with atmospheric pollution from industrial sources. From a smoke abatement point of view the most important conclusion to be drawn from the Ridley Report is the very great need for such a Committee.

Question in Parliament

Mr. Dodds asked the Minister of Health what decision has been reached in respect to the allocation of a grant to the Smoke Abatement Society to assist that organization in its work on the problem of air pollution.

The Parliamentary Secretary to the Ministry of Health (Miss Patricia Hornsby-Smith): My right hon. Friend has informed the Society that he is not prepared to recommend that a grant should be made to them.

Mr. Dodds: Is that not a most unsatisfactory answer in view of the fact that several thousand people died in London alone as a result of air pollution? Is not the Minister of Health concerned about this? Will he bear in mind that the Society has been doing excellent work and that never has so much been done for so many on so little?

Miss Hornsby-Smith: The hon. Member is well aware that a committee has been set up by the Ministers of Housing and Local Government and Fuel and Power and the Secretary of State for Scotland for the very purpose of investigating this matter, and it is far more likely to produce the results required than is a body over which the Government have no control. 21st. May, 1953.

Smokeless Zone for Airport

Ringway Airport will be the first airport in the country with its own " smokeless zone " if a Manchester Health Committee plan is approved. The committee believes that this would reduce haze and improve visibility for pilots. The main problem is to prevent smoke from the hundreds of houses on the nearby Wythenshawe estate.

From our Photo-Library, No. 17 *E. Huntly Woodcock*

Fishing Port

Consumers' Views

The Electrical Association for Women, which is a member of the Society, has published a report (*Towards Perfection*, E.A.W., 35 Grosvenor Place, London, S.W.1, 8vo., pp. 42, 2s. 6d.) on its recent extensive survey of the domestic uses of electricity. It is based on the replies to a detailed questionnaire completed by 1,280 consumers in all parts of the country, and collates their views on the 10,076 electrical appliances they use. It is of great practical value in revealing the habits, wishes, criticisms and ideas of the woman in the home. There is one paragraph, in the chapter on electrical washing machines, that provides most interesting evidence on the effects of air pollution:

"What is noticeable is the widely differing time spent on laundry work by families of equal sizes, for causes frequently related to locality. Women living in small towns can scarcely realize the effect of an industrial district on personal and household laundry: side by side were examined questionnaires where identical machines of well-known make were used for two families of four adults. The one was from an industrial town in Lancashire, where it was said that the machine was in use over a period of three hours weekly; the same type of machine in rural Worcestershire was operated between one and two hours weekly."

A Note on Synergism

One of the commonest flaws in man's thinking and at the root of many of his failures to make a true assessment of his problems is the fallacy of the single cause. We tend to over-simplify, to concentrate on one factor to the exclusion of others and to make our reasoning simpler by ignoring the fact that the causes of an effect may be numerous and complex. Moreover, it is often not recognized that two or more causes, operating together, may produce an effect very different from the sum of their separate effects.

Medicine has a term for this, namely, " synergism," which is defined as " the harmonious and co-operative action of two or more agents."

The possibility of the synergistic action of atmospheric pollutants is a matter that should not be overlooked when dicussing the effects of pollution, and particularly when ascribing blame to one or other of them. The main constituents of general pollution (as distinct from special local forms) are acids derived from the sulphur in coal, mineral matter from its ash, and solid and tarry hydrocarbon material from the volatile matter of incompletely burned coal. It is sometimes argued that since the sulphur acids are the active corrosive or otherwise injurious agents the elimination of carbonaceous smoke and ash would have no great effect, except by the absence of black deposits. The point is of importance because, especially with respect to domestic fires and other small installations, the removal of sulphur gases is theoretically the most difficult problem of all. Even the smokeless solid fuels contain sulphur which passes into the atmosphere. Therefore, the argument tends to run, if we cannot get rid of the acids, is it worth while bothering about the smoke and the ash?

This overlooks the likely synergistic action of acid, soot and ash, on which there is increasing evidence. Thus there is the now classic experiment of Dr. Vernon, who found that a sample of iron corroded rapidly in a smoky atmosphere, where it was affected by acids plus carbonaceous particles; whereas when it was enclosed in a muslin bag, so that the acid but not the solid particles could reach it, corrosion was much less.

Similarly, it has been shown that stonework is attacked more rapidly by an acid-laden sooty deposit which holds the acid in close and lasting contact with the surface.

Of particular importance is the possible synergism of the three pollutants on the human body, and it is of interest to note the views of the medical authors of the Federal report on the Donora smog episode of 1948. They wrote (page 162):

" It is well-known that one substance may influence the physiologic action of another, and it is possible that there was a summation of the action of the individual irritant constituents which produced an effect greater than would be anticipated for any one of the individual constituents. Moreover, there is evidence which indicates that the effect of irritant gases can be enhanced by absorption on particulate matter. In addition to enhanced action, gases may be carried deeper into the respiratory tract than they would normally be carried in the absence of such particulate matter. This action then would carry the noxious substance into the lower levels of the respiratory system where the more damaging effects would be produced.

" It is known that irritant gases exert their effect in the respiratory tract depending largely on their solubilities; that is, compounds which are highly soluble exert their effect in the upper respiratory tract while compounds which are less soluble exert their primary action in the deeper parts of the lung. A gas, therefore, such as sulphur dioxide, which would normally exert its primary action in the upper part of the respiratory tract might produce more serious effects if it were transported to the deeper parts of the lungs, as for example, by particulate matter. Both solid particulate matter and liquid particulate matter (fog) were present in the atmosphere in large quantities during the October, 1948 episode."

McDonald, Drinker and Gordon, in their paper on " The Epidemiology and Social Significance of Atmospheric Smoke Pollution " (*Am. J. Med. Science*, March 1951; abstract in *Smokeless Air*, Summer 1952) expressed a similar view in more general terms:

" Although the highest concentration of any irritant gas ever encountered in the atmosphere is much lower than that required to do any harm to animals or man under controlled conditions, it should be remembered that multiple causation is the rule in natural disease. Any search for a single responsible agent of itself alone responsible for a morbid process is likely to be doomed to failure. Smoke itself is a mixture of many potential agents and it seems reasonable to expect some degree of synergistic action both between them and between infective and climatic factors."

The action of the agents responsible for the growth in the incidence of lung cancer is possibly another example of synergism. Cigarette smoking appears likely to be a factor promoting the disease and so does living in a smoky atmosphere. Synergistic enhancement of the effects of each factor could account for the greater incidence of the disease that has been shown to occur among cigarette smokers and town-dwellers in this country. Dr. Percy Stocks pointed out in his paper at the Portsmouth conference last year, it may be that it is more dangerous to smoke 30 cigarettes a day if one lives and works in a large town than if one lives and works in the country.

Further and recent evidence on the close association between the several constituents of air pollution is given by R. J. Irving in a paper on " Tests of Some Impurities in the Atmosphere of Leeds." (*Proc. Leeds Phil. and Lit. Soc., Scientific Section*, VI.1., 14-17, Jan. 1952). In this work the impurities determined were dust (which included all suspended matter capable of producing a stain on white paper) and sulphur dioxide. Air tests inside rooms which were not air conditioned showed the same amounts of impurities as outside, but in an air conditioned room, in the Brotherton library, where the air was purified by filtration through fabric filters, not only was the amount of dust very low, but the sulphur dioxide content was also very low. For example, during fog, with visibility 50 yards, the dust content outside was 50 stain units; in the library it was 2 units. For sulphur dioxide the concentration outside was 1.96 parts per million; in the library the figure was 0.030 parts per million—almost one-fiftieth. It is concluded that the dust absorbs almost all the sulphur dioxide, and the removal of the former removes nearly all the latter. The author states that sulphur dioxide is also removed with the dust in an electrostatic precipitator.

It is not the intention of this note to draw specific conclusions on the subject of synergism, but only to draw attention to its importance. Perhaps the only conclusion that could be drawn is that the complex and ever-varying nature of air pollution makes it extremely difficult (and perhaps indeed unnecessary) to seek to unravel completely its numerous and interlocking strands.

On the prevention of the harm done by air pollution, which is the purpose of all studies and analyses, it does however seem to be clear that the only correct attitude and policy is to seek for the abolition, or the maximum practicable reduction at any given time, of *all* forms of pollution from *all* sources.

Cement Works Dust in North West Kent

The problem of dust from cement works in the north west Kent area, which has recently been increasingly apparent, has aroused considerable public complaint. It was the subject of a conference of local authorities at Crayford Town Hall, a town's meeting at Dartford, a protest from Women's Institutes in the district, and a number of questions and adjournment speech in the House of Commons. A Thames-side Advisory Committee for the Abatement of Atmospheric Pollution has recently been set up by local authorities, mainly because of this particular problem.

At the Crayford conference a resolution was passed expressing grave concern with the extent of the pollution and asking the Government to set up a public inquiry immediately.

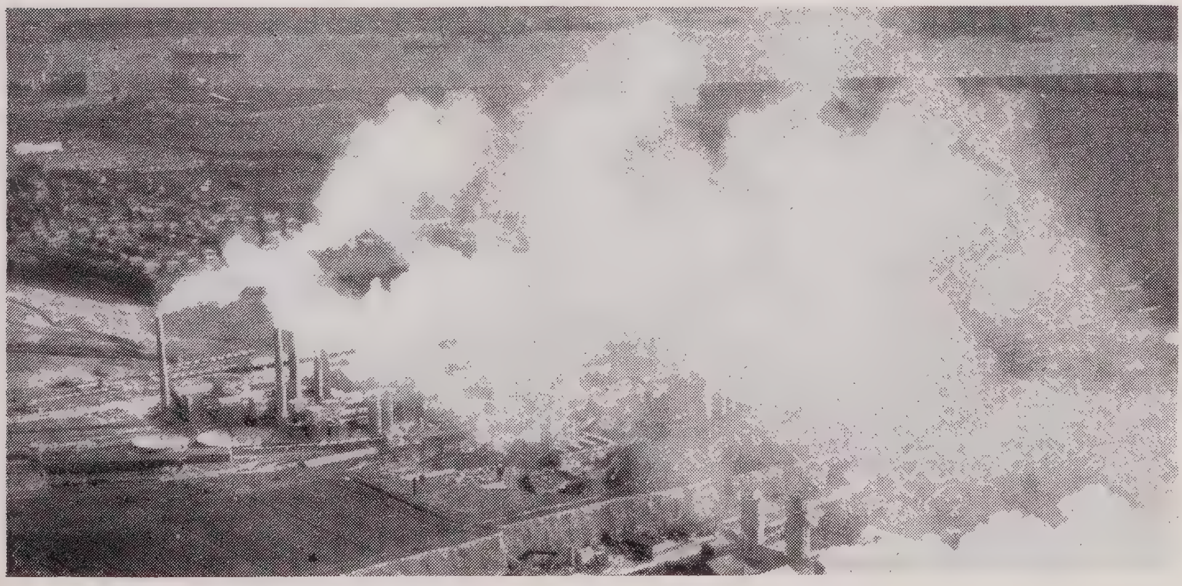
From statements made it appears that the emissions have been intensified because a number of electrostatic precipitators have been out of action at the same time, and weather conditions, with easterly winds, have brought the dust over areas that are normally not so heavily affected.

Mr. Norman Dodds, M.P. (Dartford) has asked a number of questions in the House about the problem, and also raised the matter, with air pollution more generally, in the debate on the adjournment of 8th May. He reviewed the London fog of December last, and said he had never had more correspondence on any subject than he had had on this question of air pollution. He said that " many of us feel very grateful to the Smoke Abatement Society, who are doing a grand job of work, but one of their problems is lack of finance."

In reply, Mr. Ernest Marples, (Parliamentery Secretary, Ministry of Housing and Local Government) stated that it was only since last year that the cement manufacturers were able to get the steel required to put their precipitators in order. In that area of the Thames there was the largest concentration of cement works in the world, with the exception of one place in America. The efficiency of the cement people on the Thames-side in mitigating the effects of the dust was greater than that in any other country.

Mr. Marples announced the setting up of the new committee of inquiry. He said: " The Government have decided to appoint a committee under an independent chairman, to undertake a comprehensive review of the causes and effects of air pollution, and to consider what further preventive measures are practicable."

Thames-side Cement Works. Photo by Aerofilms, Ltd.



West Midlands Division

A full, most interesting, and very successful day was held by the Division at Wolverhampton on 23rd April. A morning session, presided over by Mr. Alex W. Lee, Chairman (who is Deputy Chairman of the West Midlands Gas Board), was attended by seventy to eighty members, who were welcomed by His Worship the Mayor of Wolverhampton, Councillor H. T. Fulwood, J.P.

The main address was by Mr. T. F. Hurley, O.B.E., Chief Research Engineer, Fuel Research Station, whose subject was the D.S.I.R. smoke eliminator door. Then followed a screening of the film " Fire Without Smoke," which tells the story of the development of the door, from the urgent war-time beginning on merchant ships to its use on Lancashire boilers in industry.

Members were the guests, at a most excellent lunch, of the directors of The Midland Tar Distillers, Ltd., to the new refinery of which, at Four Ashes, to the east of the town, a visit was made in the afternoon. There was something highly appropriate about the Society making such a visit, for one of our arguments has always been that the volatile matter in coal, wasted so wantonly and harmfully in the form of smoke, is the source of products of great economic value. And it was such treatment we saw at Four Ashes.

The main works of The Midland Tar Distillers are at Oldbury, but a new site was needed for developments, especially as the Company had decided to undertake the distillation of its own tar acids. Primary distillation of the coal tar (obtained from the gas undertakings) continues to be carried out at Oldbury, from where two main fractions of oil are sent by road tankers to Four Ashes, where four 300,000 gallons tank can hold a month's supply for continuous production. The two fractions are dealt with separately, and each undergoes a series of washings and fractional distillations to separate out and purify the many constituents they contain.

The plant, which occupies a portion of the 100 acre site, is partly operating and partly still in course of construction—so that there was the added interest of noting construction and layout. Each unit is so designed that at any time its capacity can be doubled. Toluene, xylene and various grades of naphthas are among the final products obtained from the first oil fraction; at an earlier stage are obtained pyridine, lutindines, picolines, collidines and various commercial blends thereof. Crude tar acids are extracted and recovered and then are further fractionated and a large range of sales products such as phenol, the cresols and xylenols result.

There are central laboratories, which were visited, but each section of the plant has its own small laboratory, where routine tests and checks can be carried out on the spot. Research and Development and Central Engineering department are here also.

Steam is the heating medium mostly used. This is generated in a central boilerhouse comprising three Thompson Water Tube Boilers each of 50,000 lb. per hour capacity, fired with liquid pitch. It is generated at 500 lb. per sq. in. but is distributed throughout the works at three lower pressures. Pass-out turbo-electric generators are being installed. Surplus or make-up requirements of electricity will be passed to or taken from the grid.

The visit, which was favoured by a day of brilliant sunshine, concluded with tea in the Works canteen. Not only was the generous hospitality of the Company greatly appreciated—and fittingly expressed both at lunch and tea to Mr. Stanley Robinson, the Chairman, and his colleagues—but mention should be made of the friendly, but efficient way everything was organized for our benefit.

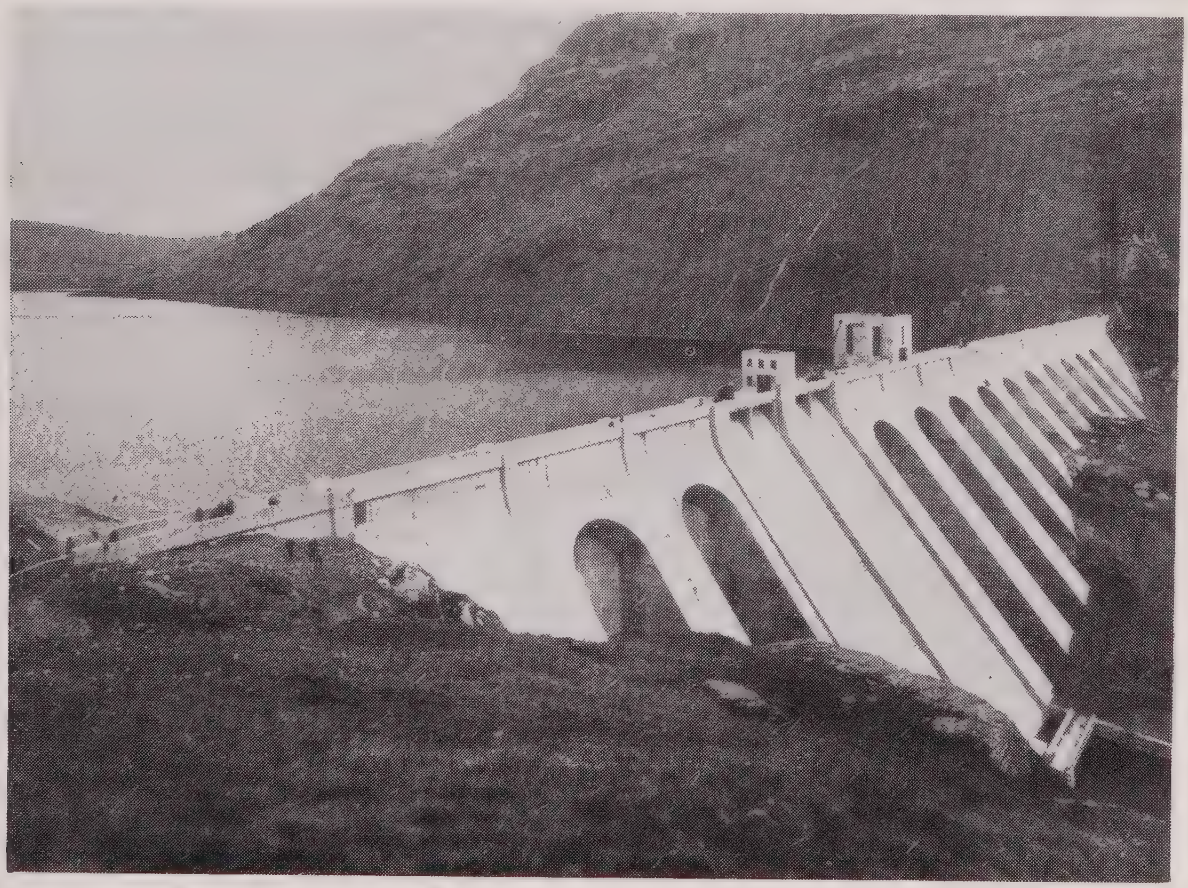
Plans for Glasgow

The September Conference

The arrangements for the 1953 conference, which is to be held in Glasgow from Wednesday 30th September to Friday, 2nd October, are almost complete. The programme, as usual, will be full and varied.

First, after the opening of the conference by the Lord Provost of Glasgow, will come Alderman Professor Tylecote's retiring Presidential Address, with the subject of which he is particularly fitted to deal—" The Local Authority and Smoke Abatement." Then, on Wednesday afternoon, will be the Des Voeux Memorial Lecture, with Sir John Charles, Chief Medical Officer, Ministry of Health, as the lecturer. His theme is to be " Air Pollution in relation to Preventive Medicine." Sir John is an old friend of the smoke abatement movement, and before the war, when he was Medical Officer for Newcastle upon Tyne, he was Hon. Secretary of the Northumberland and Durham Regional Advisory Committee for Smoke Abatement. His concern about the role of preventive medicine is clearly shown in his annual reports as Chief Medical Officer of the Ministry.

Sir John may be expected to refer to some extent to the London fog disaster, but we cannot expect him to anticipate the findings of the Ministry's committee that is examining its medical aspects in great detail and which is unlikely to be anywhere near the end of its task by September. There will, however, be a general discussion on the fog on the Thursday morning, which will be opened with contributions from Dr. A. Parker, Director of the Fuel



The Loch Sloy Dam, to be visited during the Glasgow Conference.

Research Station, Dr. J. A. Scott, Medical Officer of Health, London County Council, and Mr. Marsh, the General Secretary of the Society.

On the Thursday morning there will also be a discussion on smokeless zones, to be opened by Dr. T. M. Clayton, Medical Officer of Health, Coventry.

Solid smokeless fuels will be considered comprehensively at the afternoon session—production, distribution, price, usage, development, and so forth. At the time of writing the names of the authors of the various papers are not available, nor is the name of the author for the final, Friday morning, session, which will deal, fairly technically, with pollution problems arising from the use of liquid fuels, both in industry and transport.

Sessional Chairmen will include Sir Patrick Dollan, Chairman of the Scottish Fuel Efficiency Committee, and Bailie J. H. Taylor, President of the Society's Scottish Division.

This will be followed by the Annual General Meeting, at which the results of the postal elections will be announced and the retiring President will be succeeded by the newly-elected President.

The meetings will be held, by invitation of the Lord Provost and City Council, in the City Chambers, George Square—a building of great interest, which it is hoped members will be able to inspect, with guides, after the Wednesday afternoon session. A civic reception, with dancing and music, will also be held in the City Chambers on the Thursday evening.

On the Friday afternoon there will be a tour of considerable interest, particularly for those who do not know their Scotland as intimately as they should. This is to the power station and dams of the Loch Sloy hydro-electric scheme, with a coach journey through a district of magnificent Highland scenery.

All details will be given in the complete programme to be sent to all members and representatives who are duly registered as attending. They will also receive a complete accommodation guide, and in September a copy of the useful monthly bulletin " What's On in Glasgow."

Thanks to the hospitality of the Lord Provost and his Council, and to the enthusisam of our Scottish Divisional members, Glasgow, 1953 looks like being a guid, bonnie gathering of the smoke abatement clans!

A National Smoke Abatement Week?

The Editor, Smokeless Air

May I suggest to your readers, interested in the objects of the Society, that there should be a national Smoke Abatement Week, and ask if they have any comment to offer for such a scheme?

A Smoke Abatement Week, during a suitable week, would help to focus public opinion on the menace of smoke to our standards of health, and would educate citizens in improved methods of using fuel.

As such a week would depend for its success entirely on the co-operation of Local Authorities and other organizations interested, can any idea be forthcoming, from local authority representatives and others, of the amount of support such a week would have ?

Yours, &c.,
L. E. Berridge (Alderman)
Edmonton, N.9

(*A smoke abatement week is held each year in the U.S.A. It is a suggestion well worth considering, but, as our correspondent points out, it would need a wide measure of active support from Local Authorities. It would also need a good deal of central co-ordination and the provision of posters, leaflets, and organization for securing publicity.—Ed.*)

Manchester's New Lord Mayor on Smoke

Reference to smoke abatement in the inaugural speech of a Lord Mayor is a significant event despite the ever-growing realization of the damage to health and property that smoke causes. For this reason alone the speech by the new Lord Mayor of Manchester (Ald. A. Moss) would be worthy of attention. But it is also noteworthy because it set off a chain of favourable comment in the local daily newspapers.

The Lord Mayor pointed out, in effect, that even if compulsory extension of the smokeless zone in the centre of the city was not immediately possible, much could be done by individual citizens to preserve amenities by preventing chimneys from smoking. His remarks, addressed to " citizens who join with us in taking pride in our accomplishments but who may often thoughtlessly aggravate some of the problems which confront us in preserving the cleanliness of our city," mentioned also the indiscriminate dropping of waste paper.

Thousands of pounds have recently been spent in cleaning the filthy deposits of chimney smoke from public and private buildings, brightening metal and woodwork with coats of paint, all over the city, and the Lord Mayor's address was delivered as hundreds of workmen were erecting Coronation decorations.

A *Manchester Guardian* leader the following day called upon the Corporation to press on with the enlargement of the smokeless zone and, just as important, apply the corrective spur to the innumerable firms (and public institutions) whose smoky chimneys are now an offence to the eye and to the public health.

The *Manchester Evening News* described smoke as a worse problem than litter, referred to the deaths caused by London's smoke fogs last winter, and to the need for high-quality solid smokeless fuel in quantity if the new, efficient combustion grates now on the market were to have their full effect.

Hotels and Air Pollution

General upkeep in London hotels is far heavier than it is in other European cities. In a commercial centre like Zurich, for example, or in towns like Cannes or Nice, or even in Paris, hotels do not find it necessary, as we do in London, constantly to paint their rooms; interior painting can be done once in eight or ten years. Net curtains need only be changed once a year, and not always then, whereas we have to do this five, six and seven times a year. All this is not surprising when it is realized that over 200 tons of soot and grit are said to fall on each square mile in the City of Westminster every year.—*Extract from the Chairman's (Mr. Hugh Wontner) Speech to the annual general meeting of the Savoy Hotel, Ltd., 28th April,* 1953.

FOG SURVEY

The Spring, 1953, issue of *Smokeless Air* is now out-of-print, but reprints have been prepared in 12-page pamphlet form of the article " The London Fog Disaster: A First Survey," complete with photographs and charts.

Copies may be obtained from the Society at 6d. each, or 5s. per dozen, post free. Many have already been purchased by local authorities for distribution to members of their Councils.

Home Fires Policy

Dr. Harold Hartley, Chairman, in his speech at the annual general meeting of the Company on 31st March, 1953, referred to increased sales of solid fuel appliances and to the need for greater co-ordination of effort in this field. " Considerable savings in manufacturing costs could be effected were there such limitations of the types of apparatus demanded as would permit of the application of specialization. There is some evidence that economic conditions are compelling some sections of the public to make a greater use of solid fuel; in addition, in the domestic sphere technical developments may greatly influence the relative merits from the national standpoint of the alternative methods of using fuel."

Dr. Hartley said that each new house fitted with a built-in fire increases the burden of the " fuel usage " problem. " Were local authorities and others to abandon the practice of fitting built-in fires and instead provide only open fireplace recesses in which could be placed self-contained appliances, the resulting advantages would be notable."

" The efficiency of fuel utilization would be increased in many cases by 25 per cent. or more. The design of apparatus would be improved rapidly because of the greater scope provided for technicians, following the removal of the unnecessary physical limitations which are so restrictive today. The abolition of domestic smoke at an early date, even when burning bituminous coal, which fuel carries the bulk of the domestic heating load, would become practicable and new building sites could be made smokeless zones automatically. It has been demonstrated already in numbers of houses built since the war that in the domestic sphere bituminous coal can be burned smokelessly and with high efficiency for the warming of the house and the provision of hot water."

World's Largest Blast Furnace

Claimed to be the world's largest—106 ft. high, a 26 ft. hearth, and 1,350 tons per day capacity—a new blast furnace is being erected at Cleveland, U.S.A. On air and water pollution the contractors stated: " A primary water gas washer and a secondary electrostatic gas cleaner will remove ore and coke dust from the gas coming on the top of the furnace before it is re-used to heat the stoves and underfire the boilers. Millions of gallons of water used in cooling the furnace and washing the gas will be cleaned in special sludge removal equipment to return water to the Cuyahoga River cleaner than when it was taken out."

Prize Essay

The Royal Sanitary Institute announces that the John S. Owens Prize for 1953 (for the best paper on the subject of atmospheric pollution or the ventilation of dwellings and its effect upon human health) is offered this year for an essay on " The Location of Industry having regard to the Health of the People." The prize is of £15. Full particulars can be obtained from the Institute at 90, Buckingham Palace Road, London S.W.1.

Railway Smoke Device

The Canadian Pacific Railway has installed in a round house in Montreal a new device known as the Mahr Fire Kindler. This machine cuts down the smoke from coal burning locomotives to a minimum by the proper atomization of fuel oil injected into the lighted firebox to ignite the coal over the grate. Nozzles attached to rubber tubes from the machine feed a mixture of oil and air into the firebox, which results in perfect combustion and reduces smoke about 90 per cent. during lighting-up. Montreal is considering a revised ordinance on smoke abatement, " with teeth in it."

Pittsburgh Today

This striking aerial view, is of the Golden Triangle of Pittsburgh, where the Monongahela and Allegheny Rivers meet, and where in 1758 the British forces defeated the French and fixed the United States as a member of the English-speaking family of nations.

Pittsburgh, once known as " hell with the lid off," enjoys the most far-reaching and successful legislation for the prevention of air pollution, and their 1952 report, just received from Mr. Sumner B. Ely, Superintendent of the Bureau of Smoke Prevention, quotes U.S. Weather Bureau figures which show a 69.5 per cent. reduction since 1946 of the hours of total smoke, and for heavy smoke alone a 93 per cent reduction.

British confirmation of this remarkable improvement was given recently by Dr. Andrew Topping, Dean of the London School of Hygiene and Tropical Medicine, in his Presidential address to the Conference of Medical Officers. He said, that it was a wonderful surprise during his recent visit to the U.S.A. to find that Pittsburgh had now no major smoke problem. " Their new skyscrapers of steel and aluminium, their university of 42 floors, looking for all the world like a cathedral, their beautiful public buildings and their parks were, at the time of my visit, bathed in glorious sunshine, and the sky was as blue as that of the Mediterranean. All this had been achieved in six years . . ."

SMOKE PREVENTION ABSTRACTS

200. Inhalation of Sulphuric Acid Mists by Human Subjects. Amdur, M. O., Silverman, L., and Drinker, P. (Am. Med. Assn., Arch. Indust. Hygiene and Occ. Medicine, **6**, 4, 305-313; Oct. 1952.). Normal human subjects inhaled concentrations of sulphuric acid mist from 0.35 to 5 mg/m^3. The retention of inhaled sulphuric acid averaged 77 per cent. In all subjects in respiration were observed and measured by pneumotachograph. The changes were of a reflex nature and were indicative of shallower and more rapid breathing. At concentrations of 5 mg/m^3., levels at which the acid mist was easily detected by all, changes were more pronounced but also more varied in nature. The main response at this concentration was a decrease in minute volume. The possible significance of these findings is discussed.

201. Future Developments of Gas Coke Markets. Cooke, J. O. (Fuel Economist, **1**, 8, 169-170, 24 Ap. 1953.) Critically dicussses the negative attitude of the Ridley report in regard to smokeless fuels, and outlines some of the difficulties facing the coke market today. The sellers' market is fading away and an all-out effort to improve coke quality, to evolve new and improved methods of utilization, and to find new markets, is called for. Gas and coke should be complementary fuels, but they sell mainly in different markets, Each must have its own sales policy, but these should be co-operatively integrated.

203. Radioactive Material in the Atmosphere. Dawson, K. B. (Brit. J. Cancer, **6**, p.22, 1952.) Measurements of the radio-activity of the suspended matter in the air have been carried out in London at three sites, in Manchester, and in the country at Rothamsted. The amounts show no considerable difference between urban and rural districts, but there are large day-to-day variations which in situations out of doors are affected chiefly by the wind; the more stationary the air, the greater the amount of activity. In closed places, e.g., an air-raid shelter underground, the amount may be 100 or more times greater than those in the street outside, but even these are small in comparison with the lowest amounts considered harmful to man.

204. Arsenic in the Suspended Matter of Town Air. Goulden, F., Kennaway, E. L., and Urquhart, M. E. (Brit. J. Cancer, **6**, p.l., 1952.) The arsenic content of the air in eight towns in England has been estimated at various seasons of the year. A range in these quantities of about three-and-a-half fold was found and the concentration in winter was about twice that in summer. It is pointed out that the inherent difficulty in any attempted correlation of atmospheric pollution with the prevalence of any disease is that the former is, in practice, measured only at a very few stations in the whole areas which the population in question occupies, and at these points one may or may not secure fair samples. The amount estimated are compared with those which might be liberated in cigarette smoking, and a possible summation of carcinogenic effects is discussed.

205. Dust Sampling and Lung Disease. Davies, C. N. (Brit, J. Industr. Med., 1952, **9**. 120-126). Selective dust sampling, in which only fine particles are collected, often offers better prospects of correlation with the incidence of disease than the assessment of total concentration by weight, because coarser particles are deposited in the higher bronchial tubes, from which they are excreted, while only small particles reach the aveoli. The application of this principle is discussed in relation to the nature of airborne dust.

For substantial cuts in coal costs . . .

. . . scores of industries depend on the 'Oldbury' chain grate stoker

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Smokeless combustion

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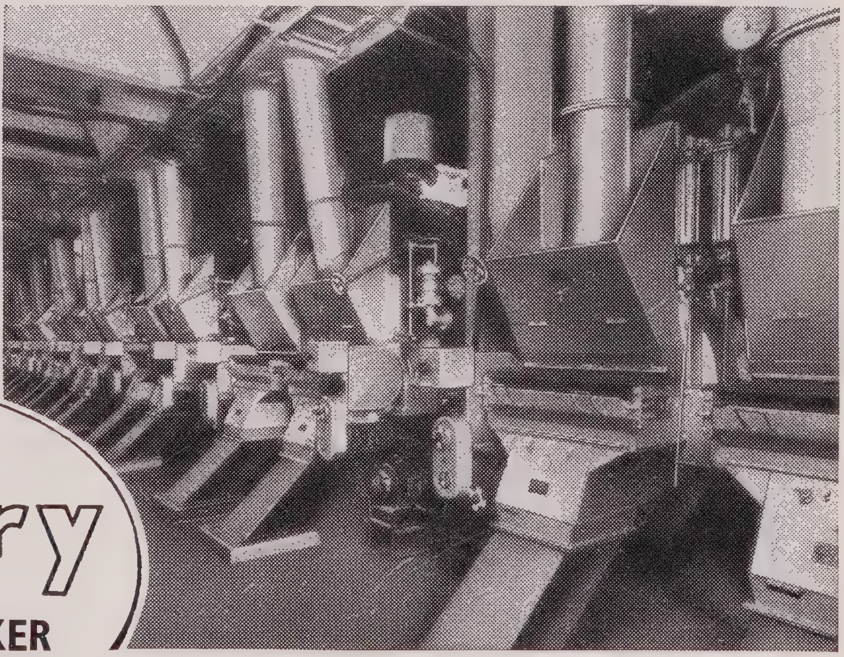
Collieries, Textiles, Potteries, Breweries, Paper, in fact, all industries where "cost per one thousand pounds of steam" is the real criterion of efficiency are realising that the "Oldbury" Chain Grate Stoker provides the complete answer by the efficient use of low grade cheaper coal.

Illustration shows 14 out of 22 "Oldbury" Stokers and Ash Extractors installed at a Scottish Colliery burning low grade "gum" meeting all steam requirements and showing a considerable financial saving.



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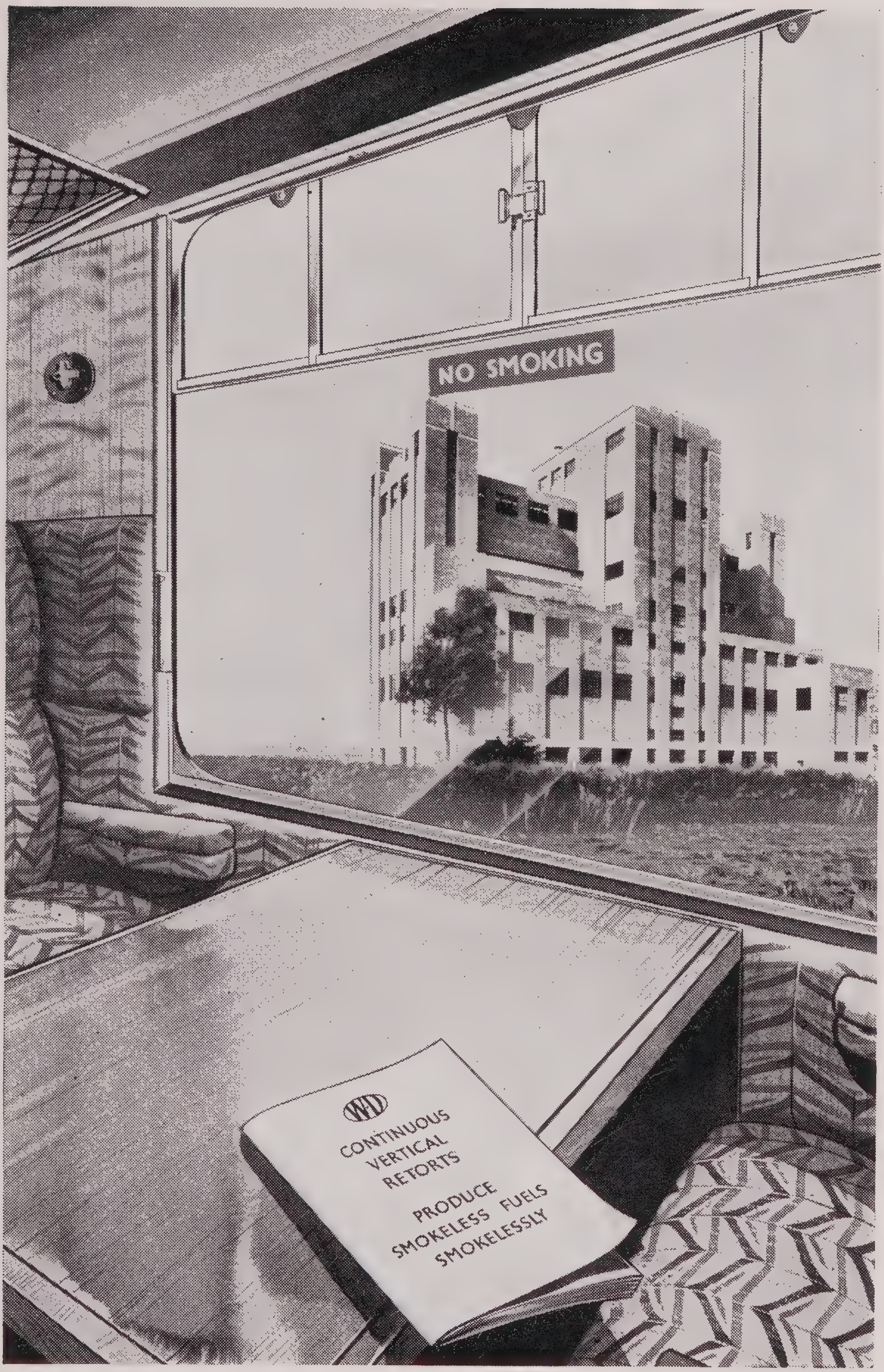
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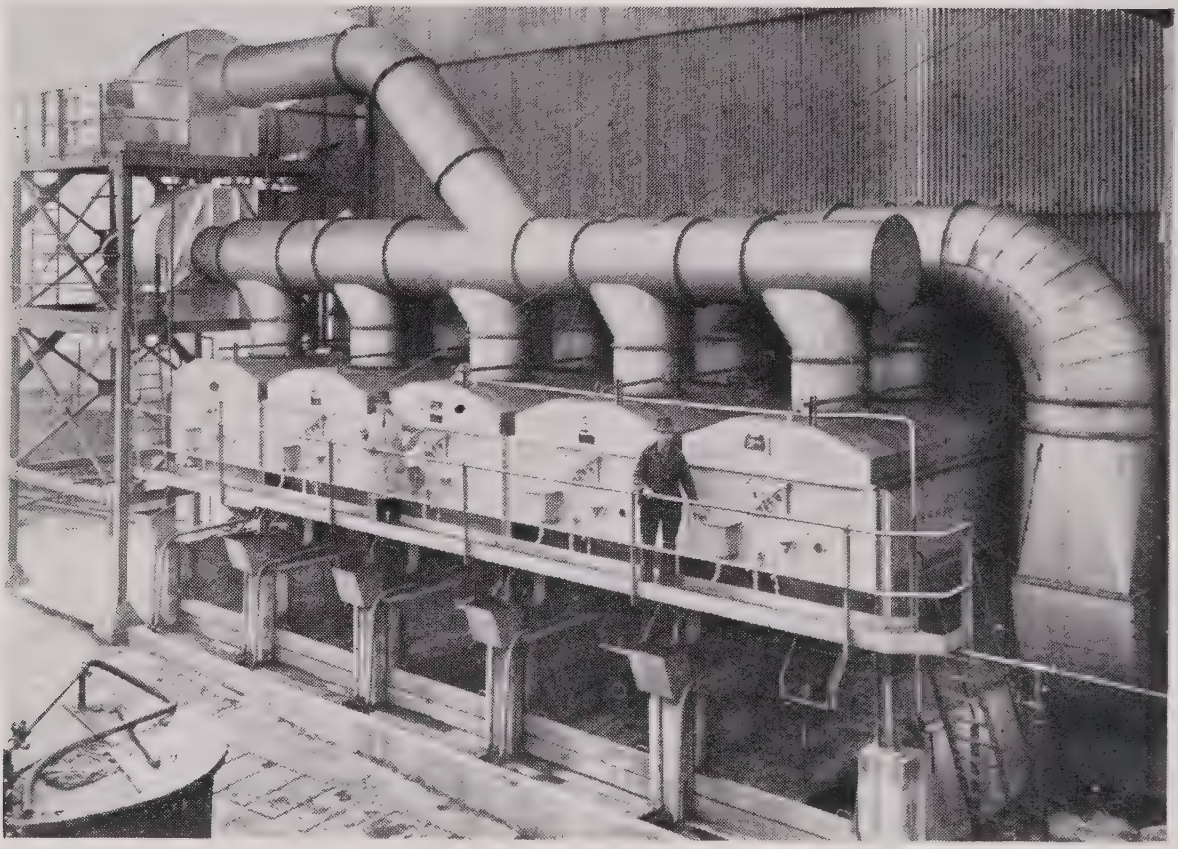

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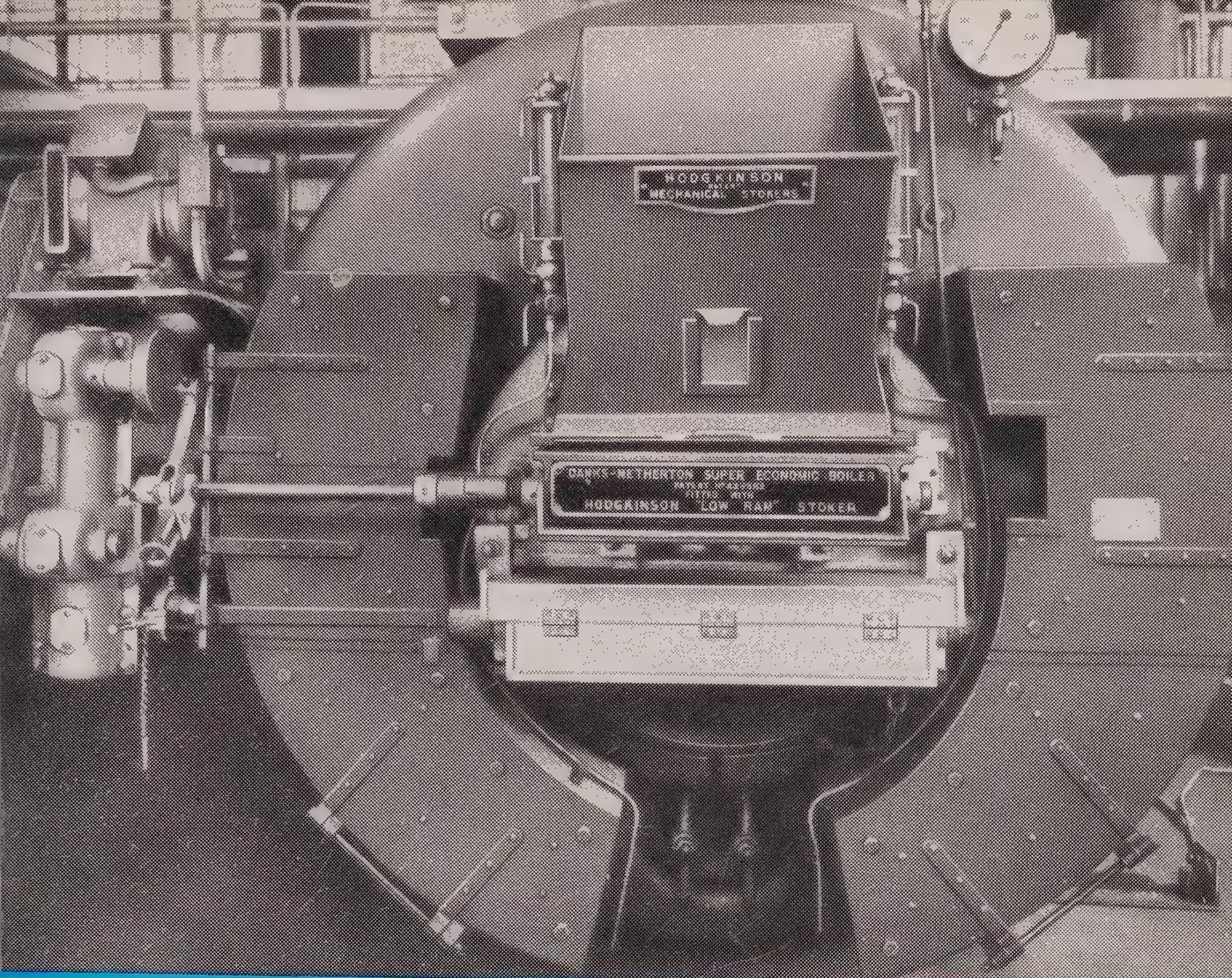
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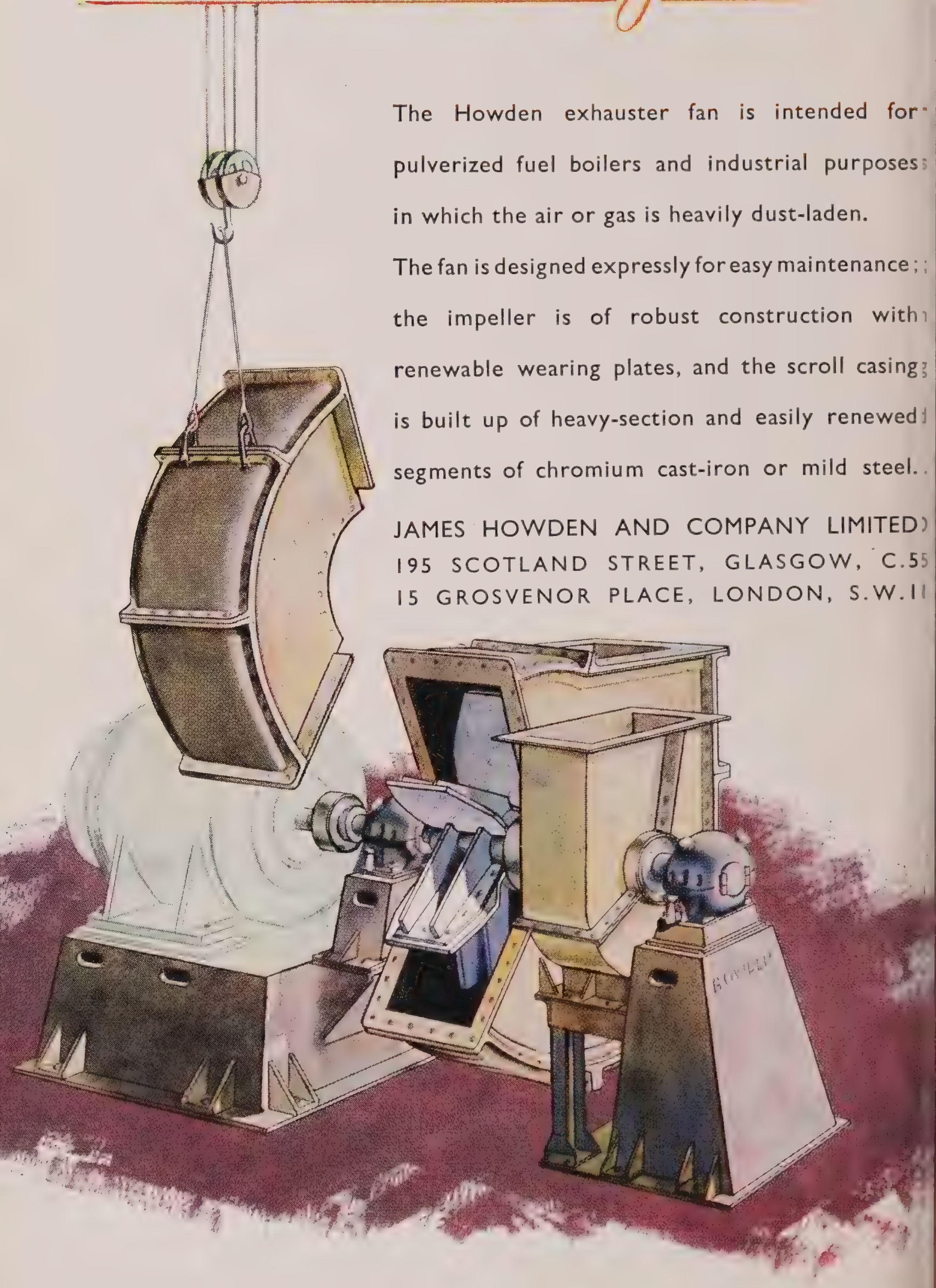

SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL

No. 87 AUTUMN 1953

ONE SHILLING

In this Issue

The New Committee
Productivity Team Condemns Smoke
Brewery Smoke Eliminated
Clifton Smokeless Housing Estate
Burning Low Grade Fuel
A Prophecy That Came True

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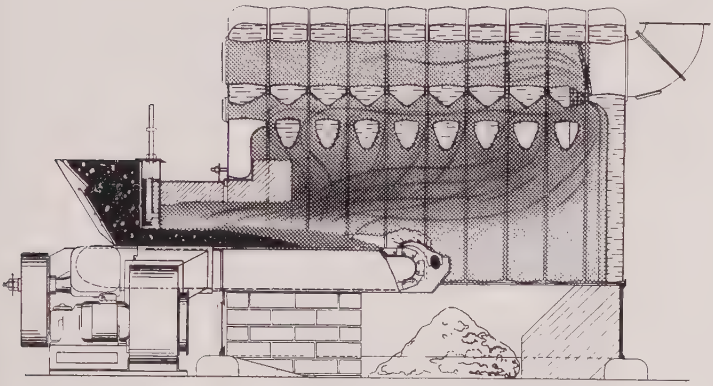
-and now the "Oldbury" MINOR stoker . . .



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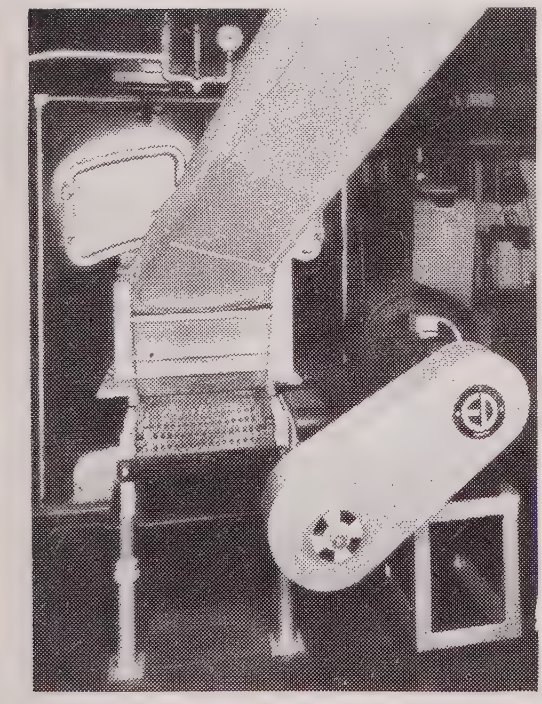

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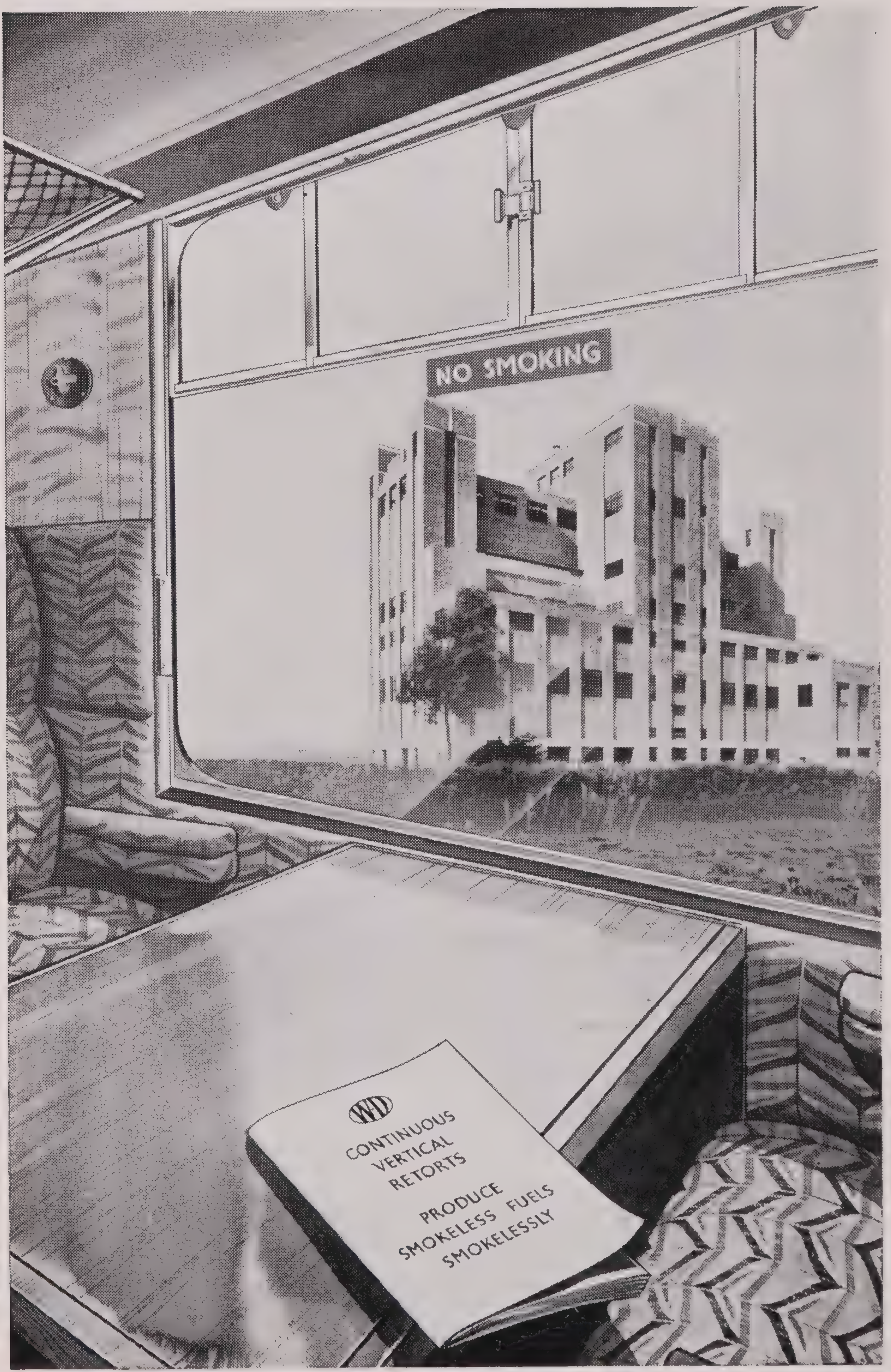
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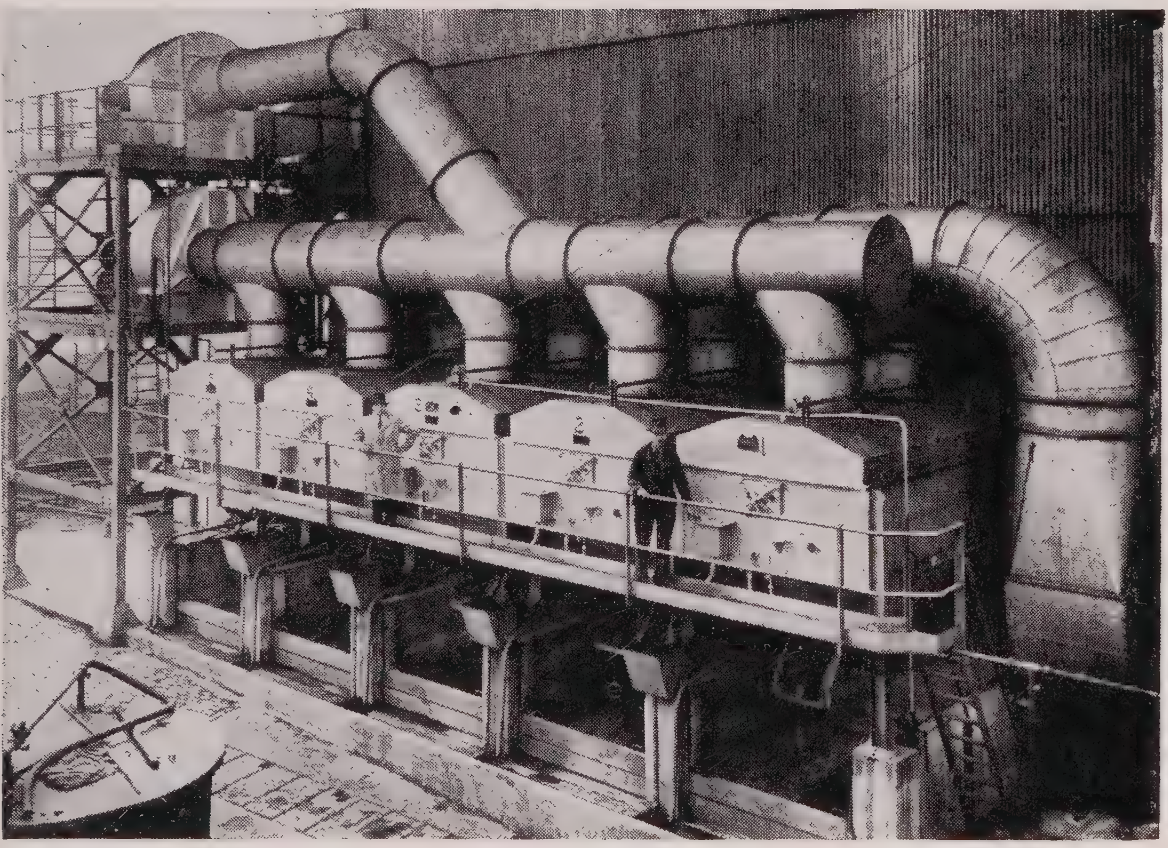

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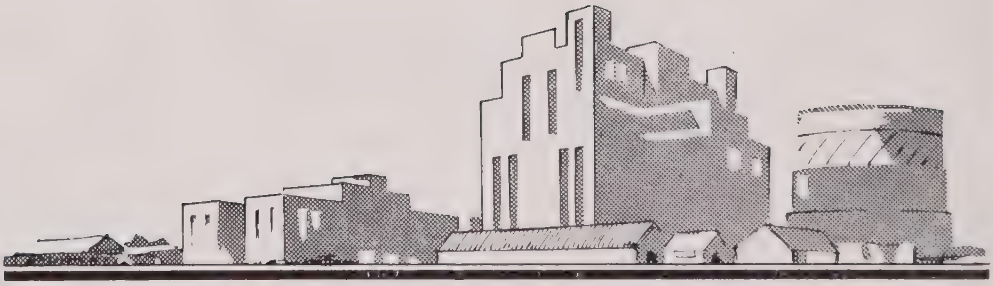

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SMOKELESS AIR

Vol. XXIV. No. 87 Autumn, 1953

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MEMBERSHIP of the Society is invited and is open to individuals, local authorities, firms and other corporate bodies. Full details and membership application form will be sent on request.

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SMOKELESS AIR

The New Committee

The terms of reference and membership of the new Government Committee of inquiry into air pollution have now been announced and are recorded on another page. The Committee held its first meeting on 24th July. We have had many favourable comments from members of the Society, not only on the individual membership, but on the wide variety and good balance of knowledge and interests on the Committee that are so necessary if such a body is to be strong and productive. Three members of the Society's Executive Council are among the members—Dr. Lessing, Chairman of our Technical Committee, whose active work for the movement goes back to the early days of the former Coal Smoke Abatement Society; Dr. J. L. Burn, Medical Officer for Salford, whose great efforts for smokeless zones in that city are only one manifestation of his deep interest in the subject; and Mr. Gordon Nonhebel, another member of the Technical Committee and author of many authoritative technical papers. In addition, Dr. G. E. Foxwell, President of the Institute of Fuel, has written important articles for this journal and the smoke problem is no new field of thought for him.

Pittsburgh Again

The striking photograph of Pittsburgh in our last issue created much interest, and Mr. Robert Griebling, secretary of the Air Pollution Control Association of America has sent us an article from *Collier's Magazine* about the great and progressive city. It graphically reviews the many developments that are transforming this once drab, smog-ridden place, and although its smoke prevention measures are only one aspect of the whole it is evident that they are an essential part. Without the prospects of cleaner air, it is admitted, there would have been no enthusiasm for the other great improvement projects. To the figures on the actual reduction of smoke given with the photograph last quarter should be added estimates of the monetary savings effected, which are given in the 1952 report of the Pittsburgh Smoke Prevention Bureau, just received from its chief, Mr. Sumner B. Ely. These show that no less than £9 millions have been saved in the year on cleaning, decorations, depreciation, laundry and the like. Sixty per cent. of this is saved by individuals and householders and the other forty per cent. by industry and commerce.

The Spiritual Uplift

Such facts and figures are one further indication of the savings we could achieve in Britain if only we would try, but perhaps what is more revealing about Pittsburgh's success story is a quotation in the *Collier's* article of the view of one of the city's leading industrialists—no doubt as hard-headed and as astute as a leading industrialist must be—who said:

" *I was in on the planning of smoke control and I can tell you that none of us realized the great spiritual uplift this would bring. If we had, we would have been fighting for it long before.*"

After years of struggling to get people in this country to believe that this would in fact be one of the finest results of smoke prevention, and without tangible evidence or testimony that it would in fact be so, such a statement is indeed heartening.

The Phases of Publicity

Mr. J. Moore, who is an individual member of the Society as well as a member of the Rowley Regis Borough Council, contributes a thoughtful and constructive article to this issue. Whatever technical and administrative measures are needed for better progress towards smokeless air it is evident that they must be accompanied by a campaign of popular propaganda and education about the problem and its solution. We cannot depend on the transitory interest aroused by such events as the London fog of December last, and smoke prevention is one of the few subjects of national urgency that has never had the backing, from any source, to make possible an effective mass publicity campaign. We admit Mr. Moore's criticism (if criticism it is) that the Society has not yet attempted such a campaign. The reason is simple: that if the funds available are so small that popular propaganda cannot be carried out with adequate intensity and over a sufficient period (reiteration is a basic need of advertising) it is far more useful to devote them to selected, smaller, influential groups (such as local authorities!). Though not neglecting inexpensive chances for popular propaganda (as in exhibitions and press publicity) this is what the Society in the main has been obliged to do—and not without success. One of the objects of the selective campaign is of course to bring about conditions that make proposals for something much bigger, such as those made by Mr. Moore, appear both feasible and necessary. To a large extent, in fact, our publicity so far has been to give the Society the chance and the means to conduct the big-scale campaign that is needed. It is in fact a two-phase job, and the switch point may be nearer than we think.

(This paragraph was written before we saw the Productivity Council Report on Fuel Conservation, which is reviewed on another page, but what we have said seems to be most aptly confirmed by the Report's generous references to the Society and the important recommendation it makes).

A Gift for the Mayor

An interesting example of what, above, we have called selective publicity, is an imaginative action recently made by another individual member of the Society, who modestly wishes to remain anonymous. Living in a large industrial town and believing that the local authority were not as *au fait* about air pollution as they should be, he purchased through the Society a comprehensive set of books, pamphlets and reports on the subject, and, as a private burgess, presented them to the Mayor of the town. The Mayor has expressed his appreciation of what he correctly calls " this public-spirited action " and after the publications have been studied by the officers of the Authority they will be placed in the Members' Library. This is the sort of direct, personal, local action that cannot be done effectively by any organization, and which, in the course of time, may have results which may exceed even the hopes of the generous donor.

Excellent ?

It is not often that we are telephoned by indignant members and asked to express disapproval of a broadcast, but this happened after a " Hints for Housewives " talk on 29th July, when Miss Mary Leigh in the course of giving advice about the use and storage of fuel, declared: " And don't despise Nutty Slack—it's good if you take the trouble, and mix it with large stuff. And it's excellent for keeping fires in all night."

It is regrettable that such a statement, and especially the latter sentence, should have been made—unless, perhaps, the speaker had gone on to explain that it was particularly excellent for increasing the chances of chimney fires (*vide* a recent report on the causation of fires); that it was excellent for carbonizing instead of burning so that it does virtually nothing to keep rooms warm overnight; and most excellent for keeping the outside air polluted during the few hours in which it has a chance to become clean.

Smoke for Art's Sake

Another member has sent us a cutting from the *Advertiser's Weekly* about a campaign the Newspaper Society is about to launch in the provincial press to " advertise advertising." One of the advertisements to be used to induce local firms to advertise in their local press carries a caption " Businesses like this " (then a drawing of a factory with five chimneys) . . ." Began like this " (drawing of small factory with only one chimney). The one chimney in the second drawing is smoking very badly, but as it obviously relates to a past era when there was widespread ignorance about both smoke and fuel economy, this may be appropriate. But all the five tall chimneys of the present day factory are smoking just as heavily, which suggests that the management haven't learned much and don't seem to deserve to have made such progress. Or perhaps the idea is that if you advertise you can afford to waste your fuel?

We have had this sort of thing before, and more seriously, we wonder why it is that a commercial artist seems to find it impossible to draw a chimney without a billowing plume of black smoke.

Coronation Honours

We congratulate two well-known members of the Society who received the M.B.E. in the Coronation Honours list. They are Mr. F. R. Jefford, Chief Sanitary Inspector, Borough of Cheltenham and a member of the Society's Executive Council; and Mr. T. M. Ashford, Chief Smoke Inspector and Technical Officer, City of Glasgow, who is perhaps best known as the Lecturer in the classes for Boilerhouse Firemen that have been so successfully organized by the Scottish Division in Glasgow for many years.

THE AIR POLLUTION COMMITTEE OF INQUIRY

In the House of Commons on 21st July, 1953, the Parliamentary Secretary to the Ministry of Housing and Local Government (Mr. Ernest Marples) announced the terms of reference and membership of the Committee, which was being appointed jointly by the Minister of Housing and Local Government, by the Secretary of State for Scotland and by the Minister of Fuel and Power.

The terms of reference are:

> **" To examine the nature, causes and effects of air pollution, and the efficacy of present preventive measures; to consider what further preventive measures are practicable; and to make recommendations."**

The membership of the Committee was given as follows:

Sir Hugh Beaver, M.INST.C.E., M.I.CHEM.E. (Chairman).

Miss A. D. Boyd, B.A., F.S.W.H.M., Housing Manager, Rotherham County Borough Council.

Dr. J. L. Burn, D.HY., D.P.H., Medical Officer of Health, Salford County Borough Council.

S. R. Dennison, Esq., C.B.E., M.A., Fellow of Gonville and Caius College, Cambridge.

Sir Roger Duncalfe, Chairman, British Glues and Chemicals, Ltd.; Chairman of the Federation of British Industries Technical Legislation Committee and Vice-President of the Federation of British Industries.

Professor T. Ferguson, M.D., D.SC., Chair of Public Health and Social Medicine, Glasgow University.

Dr. G. E. Foxwell, D.SC., F.INST.F., M.INST.GAS E., M.I.CHEM.E., President, Institute of Fuel.

Dr. R. Lessing, PH.D., F.R.I.C., F.INST.F., M.I.CHEM.E.

G. Nonhebel, Esq., B.SC., F.R.I.C., F.INST.F., Imperial Chemical Industries Ltd.

C. J. Regan, Esq., B.SC., F.R.I.C., Chemist in Chief, London County Council.

Professor O. G. Sutton, C.B.E., D.SC., F.R.S., Chairman, Atmospheric Pollution Research Committee.

The Committee, stated the Minister, will be assisted by assessors of the Ministry of Housing and Local Government, Ministry of Fuel and Power, Ministry of Health, Department of Scientific and Industrial Research, Department of Health for Scotland, and Welsh Board of Health.

TWO NEW PAMPHLETS

Because of the importance to the smoke abatement movement of the Ridley Report on Fuel Policy, the Society has prepared and is about to publish two pamphlets of excerpts from the Report under titles which are self-explanatory: " Domestic Smoke Prevention and National Fuel Policy," and " Industrial Smoke Prevention and National Fuel Policy." The pamphlets, each of 12 pages, will contain in full all the paragraphs and recommendations on smoke prevention contained in the Report, and Lord Ridley himself has very kindly written an introduction.

The price of single copies will be 6d., post-free, but they may be asked for free of charge by members and representatives of members. The Technical Committee is anxious that the pamphlets should be distributed as widely as possible among local authorities and other bodies, and quantities may be purchased at the rate of 5s. per dozen, or 30s. per hundred, post-free. Special rates will be quoted for 1,000 or more.

PRODUCTIVITY TEAM CONDEMNS SMOKE

Tribute to the Society

Since the end of the last war it seems happily to have become obligatory for any official report dealing with fuel or the use of fuel to discuss the problem of air pollution and to emphasize the urgent need for action to reduce it. The Egerton, Simon and Ridley reports are the principal examples, and now, well before what will no doubt come to be called the Beaver Report, comes an outstandingly important and outspoken statement in the Anglo-American Council on Productivity "Report on Fuel Conservation" (Published by the British Productivity Council at 5s.).

This quarto volume of 102 pages is the report of a team of twelve fuel utilization specialists who last year made specific study of power installations and manufacturing and process plants in the United States to ascertain how fuel-saving methods used in that country could be applied profitably to industry in Great Britain.

The indictment of waste in this country is so hard-hitting and sweeping that it is difficult to summarize, and one can only recommend that every reader who is interested in our national fuel problems should buy, read, and keep a copy. Before going on to refer to the chapter on air pollution we can however quote a few of the more striking passages.

"It is a sad commentary upon our national intelligence that from all the hard-won coal we consume some 80 per cent of the heat is lost, a great deal of it because of ineffective utilization."

"It has been estimated that the fuel consumption of manufacturing industry in the U.K. might well be reduced by something of the order of 30 per cent."

The Team quotes figures showing that about ten tons of excess air pass through many inefficiently operated Lancashire boilers every hour: "All this heat, which is uselessly discharged up the stack, represents an unforgivable waste of fuel on a grand scale. . . . There are 120,000 Lancashire boilers in the U.K. Its repression . . . might reduce the consumption of steam-raising fuel by as much as 10,000,000 tons of coal per annum."

(In brewing) "too often the firing of boilers is left in the hands of unskilled men, who may easily waste 500 tons of coal a year on a relatively small plant—more than the annual production of a miner."

"It is estimated that in Great Britain the entire output of 10,000 miners is wasted every year in the form of unnecessary smoke . . . the Smoke Abatement Society of Great Britain estimates that the nation pays at least £100,000,000 a year on account of smoke."

The Meaning of Fuel Efficiency

"Efficiency in the use of fuel should not be regarded as meaning only thermal efficiency. It comprises the overall effect of methods of fuel utilization upon the process as a whole, including labour costs, quality of product, rate of production and so forth. Within this broad definition there is wide scope for economy through the adoption of good practice. It governs productivity.

"By and large, British industry has not replaced or materially modified its fuel and power equipment since the first world war; it is old and inefficient. But machinery that was perhaps good enough when coal was in abundant supply and cost as little as ten shillings a ton at the pithead is not good enough today and remains an obstinate barrier to the achievement of real fuel economy.

"Somehow this barrier must be removed; an incentive must be provided to break the deadlock. This is the heart of the problem and it turns on the financial predicament of industry at large. It is unlikely that industry will maintain and improve its standard of fuel utilization unless it is actively assisted, persuaded, or even coerced to do so by legislative means. Given inducement, the many plans and projects that have been developed but perforce postponed will be brought out of their pigeon-holes."

Smoke

Chapter 19 of the report is entitled " The Cost of Smoke." It is pointed out that smoke abatement is only a part of the general problem of atmospheric pollution, but very important in any study of fuel conservation. The position in the U.S. was therefore investigated in some detail by the Team and several discussions were held with U.S. officials. A summary is given of the legislative position in this country and of the " multiplicity of ordinances " in the U.S.

The use of the Ringelmann chart in that country is commended and it is suggested that it should be used here, too, where the lack of definitions of smoke, and of dust, is regarded as one of the main difficulties in controlling nuisances. On the basis of the present law the failure to frame byelaws (under S.104, P.H. Act, 1936) for smoke other than black is certainly a weakness, and more important than the need for a better definition of black smoke, but there are matters of greater moment that the report does not discuss.

Thus, although an account is given of the methods of smoke control in the U.S. (New York City is the principal example), and the system of permits and certification for new installations, and for annual inspections, is described, no reference is made to the complete absence in the general U.K. legislation of any comparable form of prior approval. This omission of reference to one of the most important principles of smoke *prevention* is disappointing, especially as the report says of the U.S. position, that " the Team found no evidence that the regulations were interpreted in a manner to put undue burden on the consumers; on the other hand, there is no doubt that these ordinances have had a beneficial effect."

Nevertheless, one aspect of the present law in England and Wales is mentioned in an admirably direct manner. Referring to the Public Health Act, 1936, the report says:

"The weakness of this Act, however, lies in the proviso of section 109, which excepts a large range of industry from its enforcement on the ground that it would interfere with a manufacturing process. Although these exceptions were understandable in 1936 they cannot be reconciled with present-day knowledge and developments. The team suggests, therefore, that in the interests of fuel conservation alone these sections, 103-109, should be re-enacted to limit the exceptions to the absolute minimum, which in the case of those listed in the 1936 Act, section 109, would mean virtually no exceptions."

The Society

The last two sentences of the chapter must be quoted in full:

" Finally, there is no doubt that smoke abatement is so conducive to fuel saving, apart altogether from important social benefits, that the drive for the elimination of avoidable atmospheric pollution should receive official recognition and support.

" The Smoke Abatement Society, particularly, has made, in recent years, a very valuable contribution to this end, notwithstanding its limited resources."

This is a tribute and suggestion for which we are most grateful, but also, among the 40 recommendations made by the Team and included in the summary of the report we find even more specifically the following:

" **32. Every practicable measure should be taken to reduce smoke, which is usually an indication of fuel wastage.**"

" **33. The Smoke Abatement Society should receive financial encouragement from the State to expand the realistic work it has been doing, particularly for the last five years.**"

This is most gratifying and will, we trust, be officially noted. The reference to the last five years is a little puzzling, as it seems to suggest some sudden leap forward, whereas there has been a steady, continuous growth in the Society's effectiveness, each stage of which has been the foundation on which the next has been built.

Air Pollution and Bronchitis

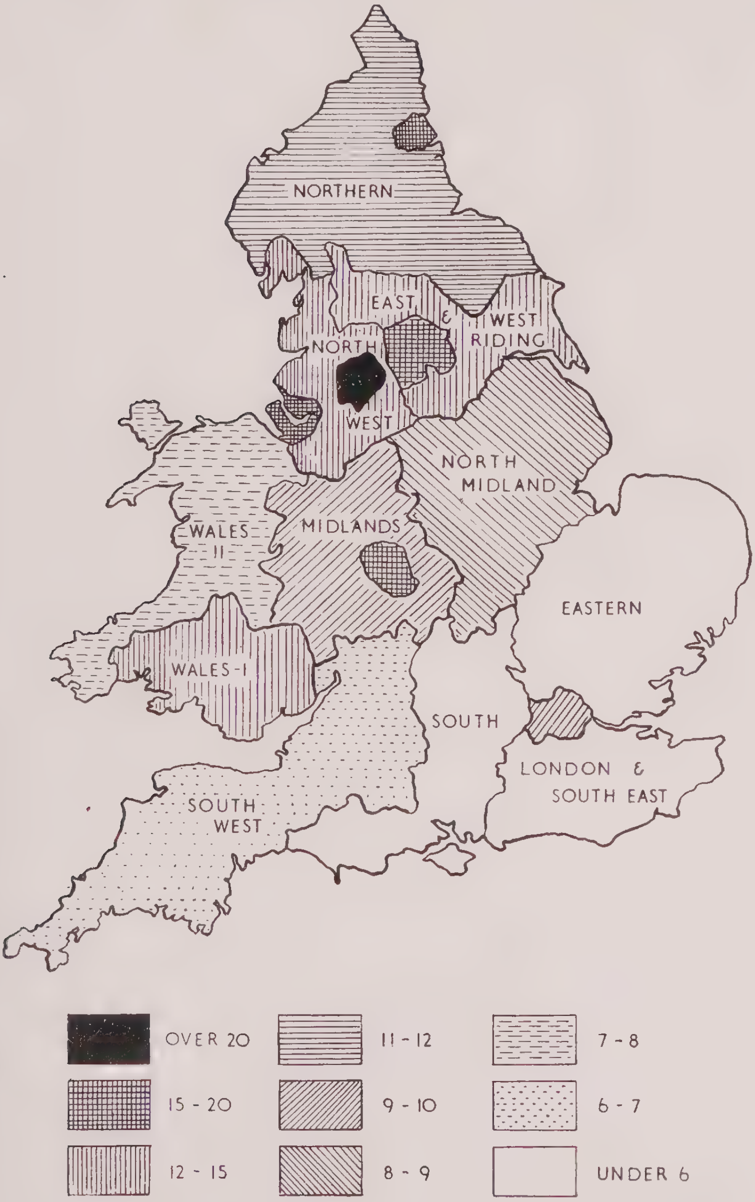
An Important Report

"Chronic Bronchitis: An Introductory Examination of Existing Data" is the title of a report published in the *British Medical Journal* of 1st August, 1953, by N. Goodman, B.SC., R. E. Lane, M.D., F.R.C.P., and S. B. Rampling, M.D., M.R.C.P., of the Nuffield Department of Public Health, University of Manchester.

The factors of sex and age, social class, region, degree of urbanization and air pollution are discussed. The accompanying regional map of bronchitis death rates for men aged 45-54, from a table in the report, is of particular interest, and may be compared with the air pollution map in a paper by Dr. C. E. P. Brooks to the Edinburgh Conference of the N.S.A.S. in 1947, and reproduced in simplified form in our booklet "Guilty Chimneys."

The authors of the report state:

"There is ample evidence that atmospheric pollution may be responsible for the deaths of many who



BRONCHITIS DEATHS IN REGIONS

Men aged 45-54
Figures represent death per 10,000

(*Based on a table in the Report*)

suffer from chronic respiratory and heart disease. The Meuse Valley disaster in 1930 and the Donora incident of 1948 are widely quoted. The extensive official report of the Donora episode showed that over 40 per cent. of a population of 14,000 were in some way affected, but that all but 1.7 per cent. were quite well within a week of the fog lifting. It was those who suffered from long-standing respiratory disease who were more likely to be killed or incapacitated for long periods. London has long provided examples of the results of the lethal nature of severe fogs, which may give a death rate of the same order as that experienced in the severest epidemics. The recent London fog was responsible for 6,000 deaths, most of which were in the age groups above 45.

" It may well be that exposure to continuous but much less severe atmospheric pollution, such as is experienced in many of our large towns, contributes to the high death rate from chronic bronchitis of those who live in industrial towns, but no evidence is available which makes it possible to be certain of this point."

Elsewhere the authors state: " There is no doubt at all that smoke associated with fog has a serious effect on the elderly and the chronic bronchitic in precipitating a mortal bronchopneumonia. Part of the excess of deaths in the poorer classes may be accounted for by their living in a more heavily smoke-polluted atmosphere."

Comparison is made with the Scandinavian countries, which with a dry atmosphere very little polluted by smoke, record very few deaths from bronchitis. The 1948 death rates per 10,000 from bronchitis in these countries for the age group 50-60 years were:

	Males	*Females*
Norway	0.2	0.4
Sweden	0.4	0.2
England and Wales	17.8	4.5

The London Fog

A Prophecy That Came True

" From the 1st to 5th December, 1930, a thick fog covered a large part of Belgium, along the Meuse Valley (flowing from W.S.W. to E.N.E.) between Liége and Huy, about 15 miles above it. A large number of people were injured; several hundred were severely attacked with respiratory troubles, and 63 died on the 4th and 5th December, after only a few hours of sickness. Many head of cattle had to be slaughtered. On the 6th of December the fog disappeared; the respiratory troubles improved and, in general, rapidly ceased. Public opinion was deeply moved, not only in Belgium but also in neighbouring countries. Wherever fogs of several days duration are frequent, public authorities were anxious to know the causes of this catastrophe and several delegates were sent to the spot. This apprehension was quite justified, when we think that, proportionately, the public services of London, *e.g.*, might be faced with the responsibility of 3,200 sudden deaths if such a phenomenon occurred there."

—The opening paragraph of a paper by Professor J. Firket, University of Liege, at a meeting of the Faraday Society, April, 1936. *The number of deaths in the London fog of 5th-8th December,* 1952, *is officially estimated to be* 4,000.

The Clifton Smokeless Housing Estate

A Lead for Other Areas

by Alfred Wade, M.B.E.

Chief Sanitary Inspector, City of Nottingham, and Honorary Secretary, National Smoke Abatement Society, East Midlands Division

The *Manchester Guardian*, in its leading article headed " Relativities " on the 17th June, 1953, commented that " we spend millions of pounds a year on bottles of medicines which may or may not relieve our coughs and colds and wheezes, but what do we spend on trying to clean the air we breathe so that one's lungs may have a better chance than hogsheads of ' mixtures ' can give them?" One answer may be that we are spending a great deal of public money in providing approved heating appliances capable of being operated without smoke, in all new municipal houses. But having provided those relatively costly appliances, steps are not taken to see that they are operated efficiently and without smoke.

The approved fire-grates, whatever the type, attain maximum efficiency when smokeless fuel is burned in them, but when fired with bituminous coal, they produce considerable smoke. To permit the appliances to be operated inefficiently and wastefully and to contribute to the smoke pollution of the atmosphere cannot be justified, particularly when it is realized that housing costs have been increased by installing those appliances.

The Nottingham City Council recently embarked on vast developments at Clifton, on the south side of the Trent and decided that the area should be developed smokelessly. A condition is, therefore, attached to each tenancy providing that no smoke shall be emitted from the premises and that all grates and other appliances using any solid fuel shall be fired by smokeless fuel. The scheme, when completed, will comprise about 5,500 dwellings. So far, the construction of about 4,000 houses has been arranged and of that number, about 1,650 are now occupied. Each house has one approved open grate of the all-night burning type and with a gas ignition fitting. The firegrate has a back boiler for water heating and an electric immersion heater is also fitted to the hot water storage cylinder. Cooking is by gas.

The smokeless area is proving a great success. To visit this vast housing estate on a cold day and see no smoke emissions from its many chimneys is a unique experience. It is a striking and practical example of the soundness of the smokeless zone policy.

Clifton is now the largest smokeless area in the country and will eventually cover about 1,000 acres of newly developed land. It differs from the Manchester smokeless zone in that it deals only with new development, whereas the Manchester scheme comprises a built up central area of the City. It is all to the good that these initial schemes should have totally different characteristics in order that the widest experience may be gained in these early steps towards a smokeless Britain.

To succeed in the development of smokeless areas on housing estates an ample supply of smokeless fuel must be assured and prior consultation by the local authority with representatives of the Ministry of Fuel and Power, the Gas Board and fuel merchants, should overcome any difficulty in that respect.

The principal fuel used at Clifton is gas coke. It is important that the correct grade of coke, as specified on the card of instructions issued to each tenant, is used. Manufactured solid smokeless fuels sold under proprietary names are also used and have proved most efficient when used alone or mixed with gas coke.

Difficulties in using the new appliances arise infrequently and are usually due to:

1. Lack of knowledge and experience in the use of the new type fireplaces. Visits by an experienced officer to each house at the commencement of the tenancy and practical demonstrations on the estate should be arranged.
2. Unsuitable grades and quality of coke. Full co-operation of fuel merchants is necessary in this connection.
3. Unsatisfactory fitting of the appliances. Attention to the sealing of the grate-sides with fire cement and the correct alignment of the gas ignition points may be necessary.

It is sometimes alleged that coke fires discharge fumes into buildings. Such a statement is, of course, erroneous. If the chimney flue and the appliance are efficient, the products of combustion must be carried off irrespective of the type of fuel in use. If fumes from the fire are apparent inside the building, an investigation into the cause should be carried out.

The cost of running a house without emitting smoke is also an important consideration for it has been argued by those opposed to smoke abatement that the cost of using solid smokeless fuel is higher than when bituminous coal is used. It is true that the cost of coke and other solid smokeless fuel per ton is generally higher than the cost of raw coal. But the value of the higher efficiency and the various savings which accrue from the use of smokeless fuel must also be borne in mind. A ton of coke has about twice the bulk of a ton of coal; when the modern grate is used smokelessly, maximum efficiency is assured; and the absence of soot, etc., from smokeless fires reduces the expenses of cleaning, washing, re-decorating and chimney sweeping. These factors without doubt, offset completely any additional cost of smokeless fuel. Moreover, the value of clean air to life and property cannot be estimated but must be enormous.

Every housing authority may now embark on the development of a smokeless housing estate with confidence. No parliamentary powers are necessary. However small the area may be, its value in the moulding of public opinion in support of a smokeless Britain will be great. Moreover, the general support now forthcoming in respect of schemes to promote a clean atmosphere should encourage progressive local authorities to proceed on similar lines to those adopted at Clifton.

Gas and Electricity Look to the Future

A large-scale search for natural gas in this country is being planned, and discussions have been held between the Gas Council and the Anglo-Iranian Oil Company with a view to explorations being carried out over a period of five years. This is one more indication of the many possible developments that may aid the campaign for cleaner air. Another example of co-operative effort is the trials being made to establish the feasibility of a power link between the national electricity systems of Great Britain and France. The prospects of using in our homes power from the waters of the Alps, and gas from deep beneath our soil, with no trace of air pollution in the making of either, are indeed stimulating.

THE DIVISIONS

South East Council Formed

A well-attended meeting of members and representatives in the South East Division was held at the Caxton Hall, Westminster, on 26th June. The President, Alderman Professor F. E. Tylecote, was in the Chair, and was supported by Sir Ernest Smith, Dr. R. Lessing, and Dr. A. Shinnie, Medical Officer for Westminster. After statements from the platform on the need to set up a Divisional Council similar to those successfully working in other parts of the country, there was a general discussion, at the end of which a motion was carried, without dissent, that a South East Divisional Council be formed. It was further agreed that the elected representatives to the national Executive Council from the South East Division should act as a provisional committee for the purpose of drafting a constitution to be placed before a later meeting of the Council for approval.

One of the papers read at the two-day conference of the **Scottish Division** at Galashiels on 28th-29th May is published in full in this issue. The President of the Division, Bailie J. H. Taylor, presided, and at the opening session delegates were welcomed by the Provost of Galashiels. Other papers read were on " Coal Conservation and Smoke Abatement," by Thomas R. Cameron, " The Contribution of Central and District Heating to Smoke Abatement," by H. H. Grattridge, Ministry of Fuel and Power, and a short " Progress Report " by the General Secretary of the national Society. A visit was made to the Galashiels Gasworks, and, by invitation of the Burgh Council, a most enjoyable evening motor coach tour took delegates over some of the moors and hills of the country of Scott and the Ettrick Shepherd.

The **Yorkshire Division** met at South Elmsall on 13th July, where after a business meeting and snack lunch, a small party visited the South Elmsall Colliery and went down the mine.

The Scottish Divisional Conference at Galashiels

A CONFERENCE ON SMOKELESS ZONES

The growing interest in smokeless zones, and the practical questions arising from the standards they require, was shown by the calling of a special conference on the subject by the Combustion Engineering Association, which is concerned with the interests of manufacturers and users of fuel-burning appliances. This was held in Manchester on 23rd June, 1953, and was attended, in addition to their own members, by a number of invited members and representatives of the N.S.A.S.

Four addresses were given. In the first Mr. R. A. Howson, of the National Coal Board, carefully developed the argument that there were not enough smokeless fuels available, or possible in the forseeable future, to make possible any large scale extension of smokeless zones. Therefore the cause of smoke abatement could only be damaged by an ill-considered insistence on the complete abolition of smoke in smokeless zones.

Mr. W. C. Moss, Technical Manager of the Coal Utilization Council, spoke on the smokeless firing of domestic premises. He thought the long-term solution was the smokeless combustion of bituminous coal, which was likely to be achieved by some kind of closed appliance rather than a hand-operated underfeed open fire. He linked the benefits of smoke prevention and fuel efficiency that might be achieved—" killing two birds with one zone."

Mr. E. Murphy of the Gas Council and Mr. T. E. Tinley spoke on smokeless firing in commercial premises. Mr. Murphy described new gravity-feed coke-burning appliances, and Mr. Tinley dealt with the smokeless operation of underfeed stokers. Smoke, he said, could be avoided if the right grade of bituminous coal was used. Mr. S. N. Duguid, speaking as a fuel technologist, gave the final address on the smokeless firing of industrial premises, in which he reviewed the principles on which efficiency and smokelessness depended. A summing-up of the papers and discussions was given by Dr. A. C. Dunningham.

Comment

The most significant point about the conference was the fact that it should have been thought desirable. The addresses touched usefully on many of the practical problems of how the requirements of the different types of premises in a smokeless zone might be met, but did not reach down to the more important question of operational standards and day-to-day administration that are emerging. Should the aim be, for example, very high standards (i.e., complete prohibition of any visible emissions) in small areas, or somewhat lesser rigidity that might be called for in larger areas that include large-scale industrial installations? And until its availability is considerably increased, should smokeless fuel be devoted to domestic use (where bituminous coal cannot be burned smokelessly), or should domestic use be limited to allow such fuels to be used in commercial premises (where bituminous coal can be burned almost, if not entirely, smokelessly)? Perhaps the answer to these and similar questions is that for the time being different approaches should be tried in different areas, thus meeting the Simon Committee's desire for " experimental " zones.

Mr. Howson, who so logically showed the difficulties of obtaining enough smokeless fuel for all desired requirements, unwittingly strengthened the case for smokeless zones. If smokeless fuel production could be extended easily and rapidly to any required degree, there would of course be no need to bother about smokeless zones. We could go steadily ahead in making the whole country smoke-

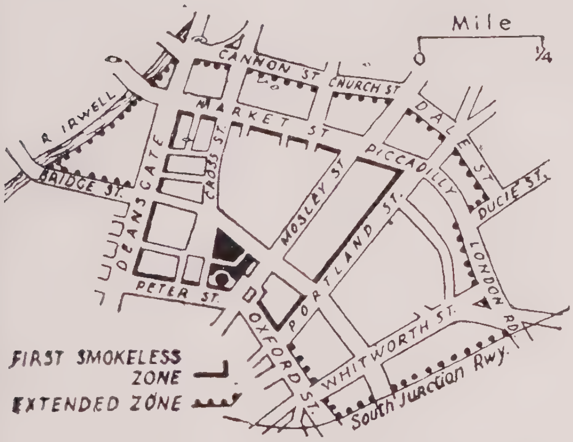
(*continued at foot of next page*)

SMOKELESS ZONES NEWS

Manchester's Proposed Extension

The Manchester Health Committee have approved a proposal by the Medical Officer of Health, Dr. C. Metcalfe Brown, that the existing smokeless zone be extended marginally to include a further 130 acres. A survey of the new area showed that it contains 516 separate premises, in which 6,694 appliances for heating, cooking, hot water and steam supply are in use—355 of them in premises used as dwellings. 5,115 of these appliances are smokeless, using gas, electricity or oil; 431 use solid smokeless fuel but are not smokeless during lighting up, and the remaining 1,148 using coal are not smokeless.

The accompanying map, reproduced by kind permission of the *Manchester Guardian* shows the areas of the existing and of the extended zones.



Manchester Corporation is also seeking, by persuasion, to create smokeless areas in six districts of Wythenshawe, where smokeless fuel appliances have been installed in new houses.

The Manchester Health Report for 1952 contains, among other information on smoke abatement, a report on the first half-year of the central smokeless zone. Eighteen contraventions were reported during the first month of the provisions, and as they were mainly due to inadvertence the Health Committee decided that cautionary action would meet the situation. Since that time very few offences have been detected and in no case has it proved necessary to resort to legal proceedings. It is said that many members of the public have assumed the role of voluntary smoke inspectors and do not hesitate to telephone the Department about apparent infringements. Also, " a noteworthy spirit of co-operation has been revealed during interviews with occupiers of premises in the area, most of whom have expressed their approval of the new measure."

Liverpool, Birmingham and Nottingham Corporations are considering smokeless zones, and Greenock, which already possesses the necessary powers, is reported to be likely to take action in the near future. Tottenham Health Committee have recommended that a smokeless zone be established in the Markfield Redevelopment Area. Much publicity has been given, as a result of a meeting of the South East Regional Board for Industry, to the desirability of a smokeless zone in the central area of London.

Smokeless Zones Conference

—concluded

less. It is because a great expansion of smokeless fuel production is difficult that priority must be given to the areas that need smoke prevention most urgently. The harm done by smoke increases faster than increase in concentration (especially in fog) and it is far more important to clean the air in the centres of heavy pollution than elsewhere. If the map of bronchitis incidence on another page is studied it will at once be apparent which areas should have priority in smoke prevention measures.

Sins and Emissions

The Need for Mass Publicity

by J. Moore (Rowley Regis)

Every year about 5,000 people are killed on the roads of Great Britain and over the same period 60,000 people die of lung diseases such as pneumonia, bronchitis and pulmonary tuberculosis. If we consider also deaths due to lung cancer the figure increases by 12,000 to a total of about 72,000. It is not unreasonable to assume that a substantial proportion of these deaths from so called " natural causes " are, at least in part, due to the contaminants in the air we breathe. There is evidence for this in the fact that recently after four days of heavy fog in London deaths from these diseases increased by about four thousand over those for the same period of the previous year.

The comparison of the annual deaths attributed to pulmonary complaints with the fatal casualties on our roads is not without motive as both problems have one thing in common—the great part that public conscience can play in either their prevention or their mitigation. Atmospheric pollution will cease when each individual in our society is persuaded that " smog " can, and does, *kill* and when smoke emissions engender such public abhorrence that offenders are regarded with distaste as enemies of society.

The National Smoke Abatement Society, together with associated interests, has over the past years carried through admirable programmes of research and investigation with the result that there is now a considerable accumulation of scientific and technical information available to all who wish, for reasons aesthetic or economic, to see smoke abolished. It can be said, however, that the policies of the Society to date have shown a tendency towards too great an emphasis upon the scientific and technical and insufficient upon the translation and dissemination of such information in a form easily understood by the ordinary man. The successful abolition of atmospheric pollution depends in the last resort on the conversion of individual persons from burners of coal to users of smokeless fuels.

Members of the N.S.A.S. know only too well that smoke abatement is regarded by most people in this country as a problem for the industrialist. It is extremely difficult to make them appreciate the fact that the relatively small streams of smoke eddying from their own chimneys contribute to the general pollution of the air they breathe and constitute as important a menace to good health as the billowing outpourings from factory chimneys.

Convincing the Public

It would appear, therefore, that the most important aim of the Society should be to convince the ordinary householder that smoke makes " smog "; that " smog " *kills*, and that he who burns bituminous coal on open fires is as great a danger to the community as the person who drives vehicles recklessly on the roads. Public opinion must be educated to the point where it frowns most severely upon the little Neros in our midst who blissfully fiddle while their coal fires burn—oblivious or unconcerned that the smoke they are producing is contributing to the suffocation and poisoning of their fellow men.

The recommendation that the N.S.A.S. should in future give greater prominence to the task of educating the individual to the evils of smoke pollution is prompted by the following considerations: (1) that, generally, industrialists are at least aware of their sins and emissions, though they often lack either the scruples or the finance to do anything about them; (2) that the overwhelming proportion of our population are completely ignorant of either their own sins or their responsibilities; and (3) that a public opinion educated in smoke abatement will create a demand for smokeless methods of heating and it can be safely left to the business acumen of industry to meet that demand.

Road Accidents Analogy

It may not be generally known that concerned in the campaign to reduce Road Accidents is first, the Royal Society for the Prevention of Accidents, a voluntary body supported by donations and subscriptions, but also recognized by the Government and acting as its agent in matters of Road Safety. Secondly, The Ministry of Transport concerns itself in many ways but chiefly in the conducting of research and the compilation of vital statistics. Lastly, many Local Authorities set up local committees with the objects of disseminating propaganda among their inhabitants and to make such recommendations to the appropriate Departments that would improve or ensure the safety of all road users. The Ministry of Transport makes a 50 per cent. grant to each Road Safety Committee to meet the expenditure incurred.

A similar triumvirate consisting of the National Smoke Abatement Society, the Ministry of Health and the Local Authorities might well be organized to deal with the question of Smoke Abatement on similar lines. The N.S.A.S. would function much the same as it does at present but also, in conjunction with the Government departments, it would conduct nationwide publicity campaigns designed to educate the populace in the benefits of smokeless heating. The word " smog " seems to lend itself to the creation of some character which would be of value in such campaigns. The Government should continue its responsibility for technical and scientific research and the collection of statistics. Health Committees of all Local Authorities should be encouraged to embark on propaganda and educational work within their own areas and there could be no better stimulus to activity than for the Government to accept responsibility for 50 per cent. of the expenditure involved. It is considered that such a combination of effort would very soon bring the national scandal of atmospheric pollution to the same level of concern afforded to road accidents at the present time.

One further suggestion to be made is that during the winter months when fog warnings are included in the weather forecasts the B.B.C. should be asked to broadcast a short statement from the Ministry of Health appealing to all users of bituminous coal to use it sparingly and make as little smoke as possible. A simple announcement of this kind could prove to be a most powerful and subtle form of propaganda.

Happy though most people may be at the prospect of something approaching 300,000 new houses being built each year the fact that each contains at least one chimney from which smoke will be pouring into the atmosphere, serves as one more reminder of the magnitude of the task before N.S.A.S. and emphasizes the need of a more intimate approach to the question of domestic air pollution. New houses can be smokeless; it would benefit everyone if they were.

[*This interesting article is discussed in an editorial note on page* 10].

Ministry of Housing and Local Government Circular No. 19/53 (H.M. S.O., 2d.), addressed to all Housing Authorities, is on the subject of Thermal Insulation, and draws attention to the references on the importance of good insulation standards in houses made in the Ridley Report. The Ministry has also published a Memorandum on Thermal Insulation of Houses (H.M.S.O., 4d.), which gives technical information on the subject.

LOW GRADE FUEL CAN BE BURNED WITHOUT SMOKE

By John Fox, M.I.Mech.E., F.Inst.F.

During recent months a wealth of comment has been published on fog, smokeless zones and allied subjects. This is as it should be, and it is indeed heartening news to hear that Manchester's smokeless zone is to be extended. However, in the notes which follow, no attempt will be made to add to these contributions, the author confining himself to a brief examination of certain economic and technical aspects of the possibility of firing boilers with low grade fuel. That this can be achieved without smoke emission is a certainty, provided that suitable stoking equipment is available.

For many years past, smoke has been recognized as a nuisance, and since the great London fog of last December, public interest has become intensified. Let us hope that the suffering which was caused then will not have been in vain. Although no aspect of combustion technique has been discussed so thoroughly as that which results in the emission of smoke, a great deal of misunderstanding still exists about the subject, and it is often held that the terms " loss " and " smoke " are synonymous. Let us examine the facts.

" The expression ' smoke ' shall include soot, ash, grit and gritty particles." (Public Health (Smoke Abatement) Act 1926). In other words, all visible matter which is discharged with the waste gases from a furnace is officially described as smoke. To this list one exception should be added, namely, water vapour, which in certain circumstances can be visible.

A smoking chimney is not necessarily evidence of inefficient combustion, because the coloured discharge may be due to ash and contain no combustion matter. Again, a very small quantity of carbon, representing negligible combustion losses, may well discolour a large volume of gas which would otherwise be invisible. It is also true that a clear chimney can frequently be obtained at the expense of combustion efficiency simply by working with a very low CO_2 reading. From this it follows that a case often exists for installing smoke indicator apparatus, as well as the more commonly adopted and very necessary instruments used for recording CO_2 percentages.

The soot particles given off by the combustion of solid fuels are produced as the result of either incomplete combustion, or non-combustion of the volatile and heavy hydrocarbon constituents of the fuel. Their appearance is not caused by the incomplete combustion of the fixed carbon content of the fuel. It is tragic but true that many industrialists are more interested in their fuel bills than in atmospheric pollution, with its train of evil consequences. If the volatile hydrocarbons are not completely consumed in the furnace, up goes the coal bill, because of the direct loss resulting from the incomplete combustion of these constituents. There must in fact be secondary combustion. A small proportion of this unconsumed matter may show itself as smoke, but the loss from this cause cannot be measured by means of ordinary flue gas analysis instruments. It is remarkable though that such losses rarely exceed one per cent. of the total fuel burned, even when conditions seem to be as bad as they can be. On the other hand, losses due to the invisible unconsumed or partially consumed volatile hydrocarbons are often a considerable percentage of the fuel fired.

It has been pointed out that a clear

chimney is not a sure indication of good combustion conditions. On the other hand, good combustion apparatus used in conjunction with a properly designed furnace will ensure that there can be no objectionable smoke emission, because together they ensure the best combustion conditions.

The many advantages claimed for the use of mechanical stokers are too well known to be recapitulated here. In almost all circumstances, these claims should be accepted, at any rate, on theoretical grounds, even with small installations and Figure 1 shows an " Oldbury Minor " chain grate stoker firing a sectional type central heating boiler. Generally, it is an example of the cases for smoke abatement and combustion efficiency walking hand in hand, but at this juncture some economic aspects of the position as it exists at present must be emphasized.

The Price Structure of Coal

The recent action of the Minister of Fuel and Power in refusing an enquiry into the coal situation, and in particular its price structure may well have been justified for reasons of expediency. This refusal however, bears hardly on the industrialist who is doing his best to aid the vital national effort to export more high-grade coal. To achieve success in this matter is a sheer economic necessity, and much can be done to improve the position by using larger quantities of low-grade coal to fire industrial and large central-heating boilers than is attempted at the present time.

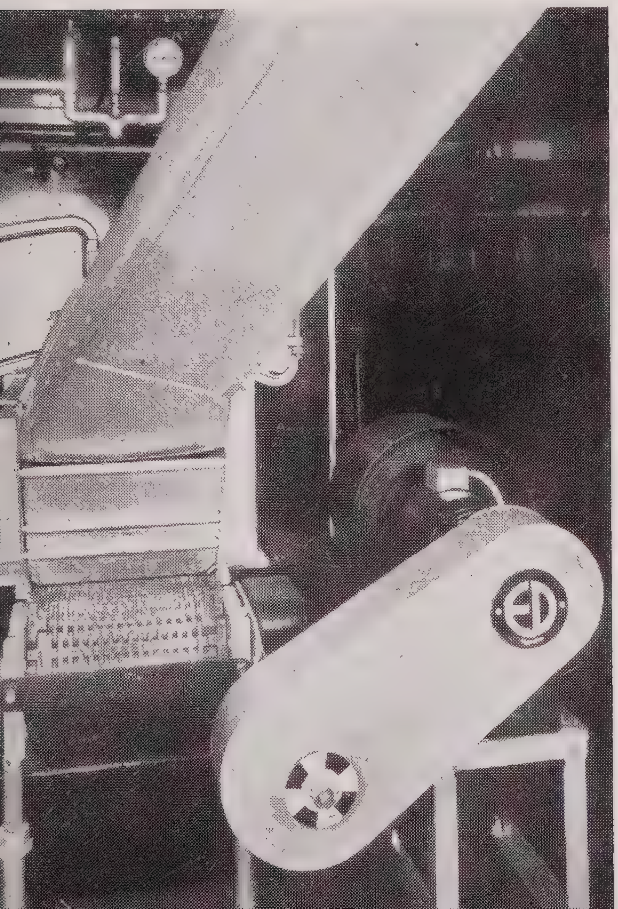


Fig. 1. Oldbury Minor
Chain Grate Stoker

Most engineers are well aware that it is possible to purchase combustion apparatus which would make possible the maintenance of full boiler output with the very lowest grades of coal, not only in large power-stations, but also at the vast majority of industrial works, in which shell-type boilers are very often installed. Mechanical stoking equipment is expensive to install but its cost could be recovered in a reasonable period were the price differential between good and bad coals sufficiently great. This is not the case today. For instance, the difference in cost between good and bad coal in South Coast areas amounts to only about 7s. per ton, a figure which does not compensate for the reduced heating value and increased ash content of the inferior fuel. The corresponding average figure for the East Midlands is less than 10s. per ton.

A further interesting example of the present system of arriving at coal prices can profitably be quoted in some detail as its effect is shown on the working of a factory in the south west, where economic boiler plant is installed. The availability of these boilers using " Lady Windsor Washed Smalls " is only some five or six days, and the efficiency of the plant about 68 per cent. Of course, the matter of the chemical composition of the coal has a considerable effect on these values. On the other hand, Middle Duffryn Peas are used also in the same installation, and when this is so, the boiler efficiency increases to 78

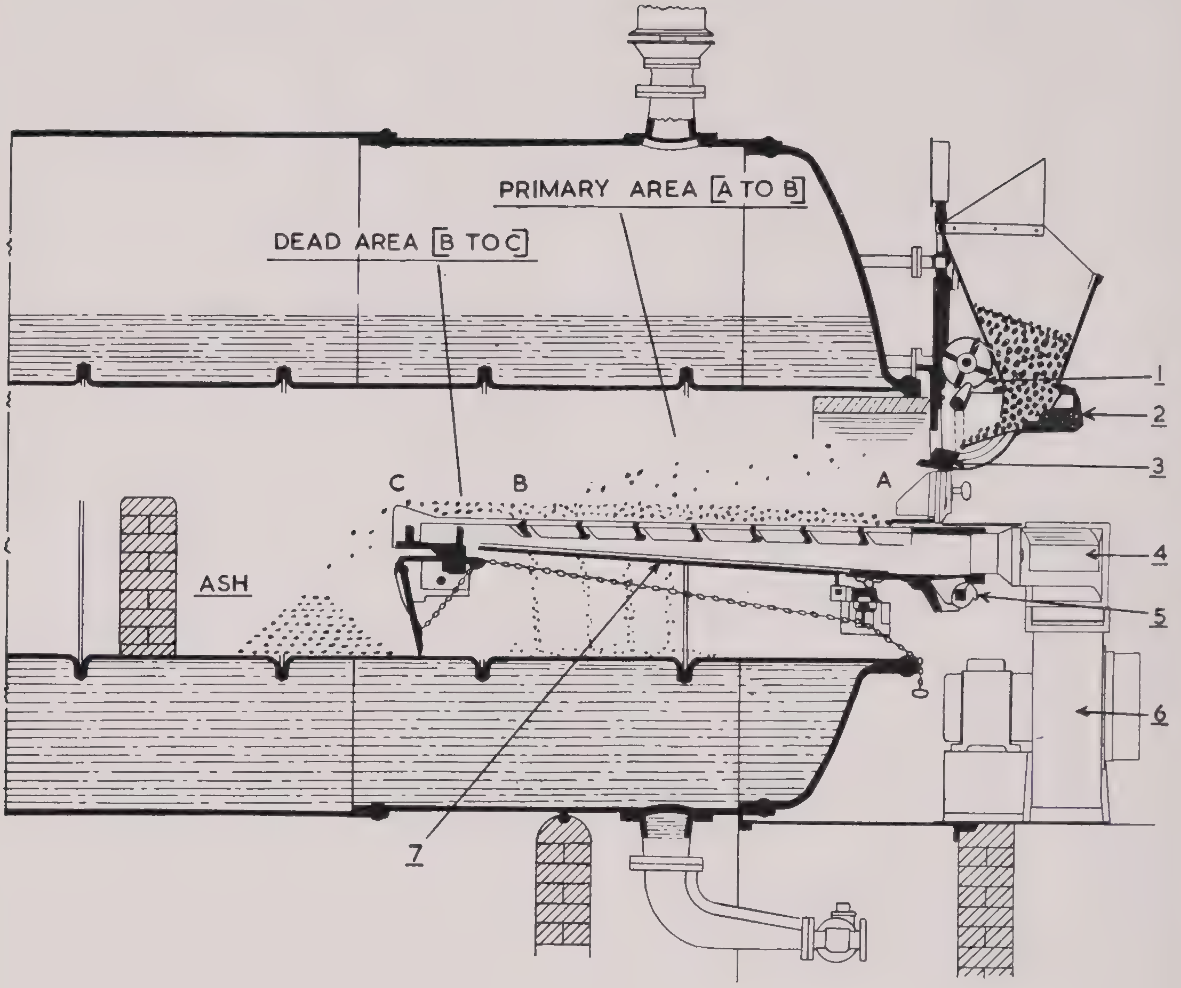


Fig. 2. " Triumph " Sprinkler Stoker

per cent. and the availability improves to something between eight and ten weeks. The " Washed Smalls " cost £4 2s. 8d. per ton, and the average calorific value of the coal is 12,900 B.Th.U's. per lb. The Middle Duffryn Peas cost £4 7s. 7d. per ton and have a calorific value of 13,700 B.Th.U's. per lb. It is not therefore surprising that the management has now declined to purchase a coal, for which, on a calorific basis, no possible advantage is offered, and by the use of which a marked drop in efficiency is suffered.

An anomaly which is very striking is instanced by the current situation in the matter of the so called " Nutty Slack " which has been such a boon to radio-comedians, even if to nobody else. Provided that suitable stoking apparatus is installed, even this " coal " can be burned efficiently, and without smoke, in the furnaces of factory boilers. The public, however, is being persuaded to use this fuel, which is off the ration, by reason of a price reduction of £1 per ton, but no encouragement is given to factory owners to burn it for steam-raising. It is incorrect to say that Nutty Slack can be burned on the domestic hearth. Carbonization would be a more appropriate term, but even so, it gives off very little heat and does produce vast quantities of smoke. The latter is of the thick, grey, oily variety and has a full quota of benzpyrene. It is of course a contributory cause of much fog and therefore injurious to health.

Financial Considerations

Until recently, for some strange reason, combustion equipment has been excluded specifically from the

Government's loan scheme for increasing industrial efficiency, and surely it was naive in the circumstances to appeal to industrialists to burn poor coal in the interest of the nation. Philanthropy is a first class philosophy but an item to be ignored on a balance sheet or when compounding with one's creditors. Present day levels of taxation hardly allow managements to maintain existing plant, let alone replacing it for the general benefit of all and sundry, the industrialist alone excluded.

The position however, in recent weeks has become more hopeful, for, under the revised terms of the Government's Loan Scheme, specific mention is made of industrial fuel saving equipment, and on far more favourable terms than were applied generally in the past. Details may be obtained from the Fuel Efficiency Branch of the Ministry of Fuel and Power. The coal industry is known to be sick, and its products must be made to go much further than at present if this country is to survive as a great industrial nation. Atmospheric pollution is the sworn enemy of fuel efficiency, and by encouraging the latter, we help in the battle against the former. Let us seize every opportunity to drive home any advantage that may be offered.

Figure 2 is a drawing of Messrs. John Thompson's " Triumph " sprinkler stoker fitted with a moving grate and provided with shovel charging. It is shown because it has been proved capable of burning lignite, a most difficult fuel, without smoke emission. The Hodgkinson " Low Ram " stoker has also a good record in the matter of combating the smoke nuisance, and along with the " Oldbury " stoker has been successful in burning peat in Ireland. It is shown as Figure 3.

Oil Fuel

A development worth watching and which may well help to relieve the pressure on the National Coal Board, is the establishment of considerable new oil refinery capacity, since the end of the war. It follows that as the output of high-grade spirit increases,

(*concluded on page 46*)

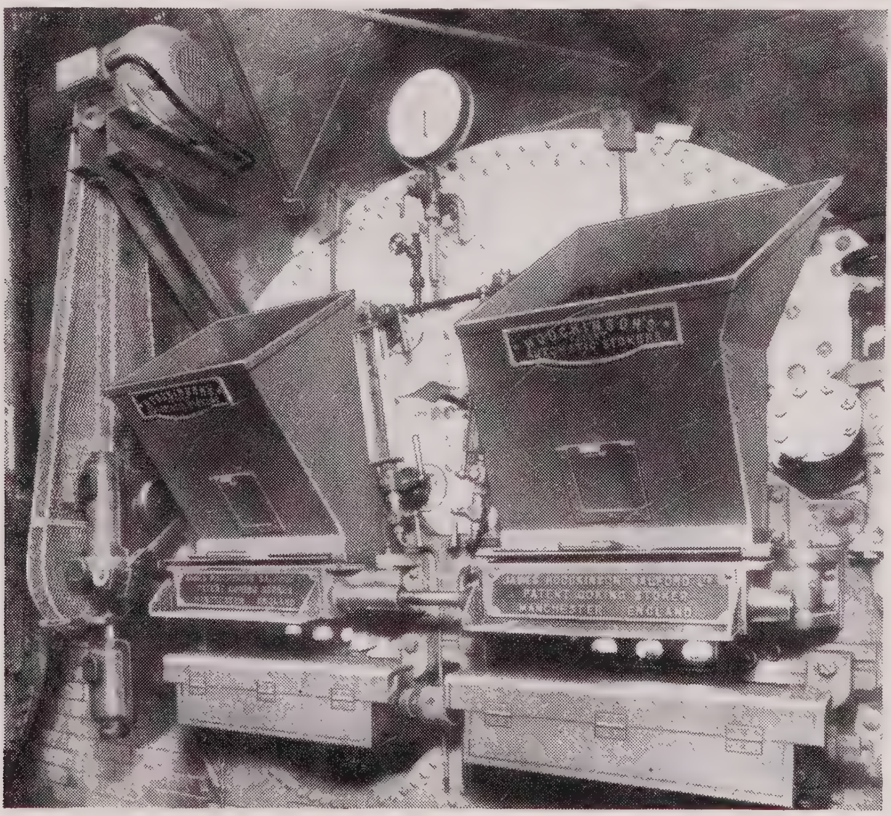


Fig. 3. The " Low Ram " Stoker

THE CASE FOR AND AGAINST BYELAWS

Experiences of a Local Authority

by W. Parker

A Paper read by the Chief Sanitary Inspector and Cleansing Superintendent, Dudley, to a meeting of the West Midlands Joint Advisory Council for the Abatement of Smoke and Atmospheric Pollution on 26th February, 1953.

I have been asked to make a few comments on the case for and against byelaws in connection with smoke emissions. Before proceeding to do this may I very briefly outline the position of a Local Authority in respect of atmospheric pollution in its relationship to the Public Health Act, 1936. There is, of course Sub-section (d) of Section 92 dealing with the question of atmospheric pollution from dust or effluvia caused by trades, businesses etc., but as I am referring only to atmospheric pollution from smoke, I merely mention this sub-section in passing.

The emission of quantities of smoke in certain circumstances can be deemed to be a statutory nuisance within the framework of Section 101 of the Public Health Act, 1936, and Section 110 of the same Act defines smoke to include soot, ash, grit and gritty particles. Under Section 104 a local Authority may, and if required by the Minister shall make byelaws regulating the emission of smoke of such colour, or density of content, as may be prescribed by the byelaws.

When I first considered the pros and cons of smoke byelaws I quickly formed an opinion that very little could logically be said against the introduction of legislation designed solely for the protection and betterment of the general public. Unfortunately the recent experience of my own local authority, following an application for permission to introduce such byelaws, shows that the Ministry of Housing and Local Government does not share this view. I decided for the purpose of this paper, therefore, to regard my local authority as plaintiffs in the case and the Ministry as the defendants.

Local Conditions

For the benefit of those who are not very conversant with the conditions within the area of the Dudley County Borough Council I will endeavour briefly to give some idea of the potential atmospheric pollution problem from smoke emission. The following table has been compiled to give an approximation of the industrial structure of Dudley (population 62,000 estimated). The table indicates under broad headings the various types of industries where processes likely to cause some smoke nuisance are carried on. These types of industry are given in percentage figures and from the total it is shown that roughly 50 per cent. of the industry of the town (and I use the term “ industry ” in its broadest sense including shops and offices etc.) is of such a nature that conditions are likely to give cause for smoke nuisances, Obviously the size of an industry can vary very much from that of its neighbour and it would be a misleading figure to base any assumption purely and simply on Column 1. To support this figure further I show under Column 2 the average number of insured workers (again on a percentage basis) engaged within these particular industries in the town and this total figure is also in the region of 50 per cent. Taking the two columns together it is reasonable therefore to assume that approximately 50 per cent. of the total industry in Dudley is of a nature where processes are carried on likely to give rise to a potential smoke nuisance.

Industrial Structure

	Industries %	*Insured workers* %
Mining and quarrying	5	9.4
Bricks, pottery and glass	6	4.3
Metals, manufacture and engineering ..	38	32.0
Textiles	1	4.0
	50	49.7

The Case for Byelaws

Fully to represent the Council's case I want it to be understood that although the industrial structure of the town is as already stated, it was not taken for granted that because of this a smoke problem actually existed. Observations were taken on a number of chimneys from industrial premises over a period of time resulting in the formation of a list of undertakings where quantities of black or dense smoke were being emitted at fairly regular intervals. As is generally the case with the work of Sanitary Inspectors an informal approach was made to these various undertakings informing them of the results of observations. This was followed by the compilation of necessary information such as type of plant, working load, type of fuel etc. etc., and in most cases resulted in the offer of advice in an effort to bring about a satisfactory solution to the smoke emission. In further cases Advisory Officers from the Ministry of Fuel and Power were called in resulting either in the carrying out of certain works of repair or improvement or the demonstration of firing to the stokers employed or both. It would be a wrong statement and would give an erroneous impression if I suggested that these endeavours were fruitless but it would be equally wrong to say there was permanent improvement. In practice it was found that a number of the undertakings gave much more satisfactory observations for a limited period followed by a return to their previous intermittent emission of black or dense smoke.

Considerable time elapsed during these early stages but it finally became very evident that the method which had been adopted was not bringing the result which it deserved nor the result that was sought after. The Health Committee of the Council were naturally dissatisfied with this state of affairs and asked that further consideration be given to the matter with a view to recommendations for further effort to clear up these very unsatisfactory undertakings. Discussions took place between the Town Clerk and myself and as one could normally expect, these discussions pivoted around the obvious need for byelaws in accordance with Section 104 of the Public Health Act, 1936, and resulted in a recommendation to the Health Committee for the adoption of such byelaws. This recommendation was accepted very readily by the Health Committee and in February of 1952 an application was made to the Ministry of Housing and Local Government for the approval of byelaws framed on the model byelaws.

The Case Against Byelaws

We have now reached the stage where the Ministry have received from the Local Authority an application for the making of byelaws in accordance with established practice under a statute which has been law for many, many years. The draft byelaw is based entirely on a model byelaw issued by the Ministry who were previously responsible for such matters, namely, the Ministry of Health. With the application was a letter which in effect stated that the application for byelaws was being made because of the Council's problem from persistent smoke nuisance.

Within a few days of the receipt of the application a letter was received from the Ministry and I can only suggest this letter inferred that the making of such byelaws would place upon industry the necessity for certain requirements likely to be difficult and asked the Local Authority to satisfy the Ministry that the byelaw requirements could be carried out:-

(*a*) without materially adding to the problems of industry,
(*b*) having regard to the difficulties arising from the lack of ancillary equipment,
(*c*) the necessity of accepting unsuitable fuel,
(*d*) the difficulties of labour for stoking and other problems.

I will now lay before you my own comments which, at the time, I made to the Town Clerk on the four points just mentioned:-

Point 1. This is to the effect that the reduction of black smoke (for that is, after all, the purpose of the byelaw) might materially add to the problems of industry. I believe I have a reasonably intelligent imagination but after stretching it to its limits I fail to see how the improved efficiency of the combustion of fuel will add to the problems of industry. Should my ignorance be greater than I now know it to be perhaps the more enlightened will put me right on this matter.

Point 2. The second inference was in relation to the difficulties arising from a possible lack of ancillary equipment. Judging from the number of trade representatives who have called in my office from time to time to tell me they are in the area in an effort to interest works managers in equipment for improved fuel combustion and also from the brochures etc., received on this subject, there does not appear to be any lack of equipment for this purpose. If there should be any difficulty I suggest that it is a short term one only in the sense that date of delivery does not immediately follow date of order.

Point 3. This referred to unsuitable fuel. Be it far from me to suggest that such a commodity does not exist but surely its distribution is so widespread that if it were impossible to use it without smoke nuisance we should be in a sorry plight indeed. At a recent meeting in Birmingham we were told by Alderman Lewis that the Midlands Electricity Board are being supplied with a very low grade fuel which, prior to the last war, was mostly unused. Without wanting to pay individual compliments I believe it will be agreed that the chimneys of the power stations are not black smoke offenders. No doubt low grade fuel is a handicap but it is a handicap which can and must be overcome.

Point 4. I will readily agree with great feeling that there are difficulties with labour in connection with stoking but so also are there labour difficulties in all branches of industry. Surely the Ministry are not seriously suggesting that Local Authorities and the managements of industrial undertakings should adopt a defeatist policy towards problems affecting most important national issues—namely—an efficient use of fuel which is one of our most important natural assets and a clean atmosphere most essential for public health and well being.

The Town Clerk in replying stated quite clearly that after consideration of the four points in the letter from the Ministry the Local Authority was still of the opinion that byelaws were essential and the byelaws could be implemented by industry without any material difficulty.

The next and final step of the Ministry was a letter indicating the refusal of the application on the grounds that " there is no evidence of a serious smoke nuisance " but the Ministry went on to say " as regards the difficulties experienced etc. etc." This latter statement from the Ministry will be dealt with in my summing up.

Summing Up

I have already dealt with the 4-point letter which was the first reaction of the Ministry to the Local Authority's application. It is a letter which, to my mind, indicated an initial lack of desire on the part of the Ministry to the making of such byelaws irrespective of whether or not smoke nuisances existed, but having received from the Local Authority an assurance that these imaginary difficulties were not a permanent stumbling block to improvement no further mention of them has been made. Instead the Ministry adopted a change of front and I suggest this change of front occurred because the inferred difficulties cannot bear examination. The second and final submission of the Ministry is equally as inappropriate as the first submission. In it is a statement which I have already quoted to the effect that there seems no evidence of a serious smoke nuisance, this in spite of the fact that considerable time has been spent not only in observations but later in attempts towards a clean atmosphere. Strangely enough, however, the letter which bears this amazing statement goes on to suggest that the Local Authority seek the co-operation of the advisory services of the Ministry of Fuel and Power to deal with " the difficulties experienced." In view of the Ministry's suggestion that there is no evidence of a serious smoke nuisance one naturally asks what are the difficulties to which the same letter refers, the answer to which would be —difficulties arising from the persistent emission of black smoke. There may in Ministerial circles be an official difference between a serious smoke nuisance and the difficulties now being experienced in Dudley from the emission of dense and black smoke from the chimneys of industrial undertakings but in practice I cannot see where this difference arises. One further comment I make about the final suggestion of the Ministry for co-operation with the Ministry of Fuel and Power and it is this—full co-operation has been in existence between my department and the Ministry of Fuel and Power for some considerable time but it must be remembered that the officers from the Ministry of Fuel and Power are prepared to visit industrial undertakings in an advisory capacity only and it does not necessarily follow that any advice given will be accepted.

I have tried with indifferent success to outline what, in my mind, is the case for and against byelaws for smoke nuisance and I suggest it can be reduced to the following points:-

(1) The Public Health Act, 1936, gives a specific authority for Local Authorities to make byelaws.
(2) An application was properly made in accordance with this authority after suitable evidence had been gathered that persistent smoke nuisances existed within the area.
(3) The application was " cold blanketed " from the outset by a

(*concluded on next page*)

Correspondence

OLFACTORY SELECTIVITY

The Editor,
Smokeless Air

Sir,

Mr. Donald V. H. Smith is truly a remarkable man!

In his letter to you in the summer number of SMOKELESS AIR he claims that he could smell sulphur dioxide from London power stations as far away as Park Lane on the foggy night of 5th December last year.

How he was able to distinguish SO_2 emitted by tall power station chimneys over a mile away from that produced by much shorter chimneys discharging SO_2 from coal and coke fires, and oil burners, in the immediate vicinity passes my comprehension.

I would respectfully suggest that Mr. Smith's remarkable olfactory selectivity should be brought to the notice of the authorities.

Yours, etc.,

Croydon. PHILIP HONEY.

Los Angeles Smog Film

A film, "The City that Disappears," supervised by the Stanford Research Institute, California, on the smog problem in Los Angeles, is being borrowed during the autumn by Mr. Peter C. G. Isaac, a member of the Society. Members and organizations who would like to have the loan of this film for showing at meetings are invited to inquire from Mr. Isaac, whose address is the Public Health Engineering Laboratory, King's College, Newcastle upon Tyne, 1.

Mr. Isaac is also Hon. Secretary of a newly formed British Occupational Hygiene Society, of which the first President is Dr. T. Bedford, Director of the Medical Research Council's Environmental Hygiene Research Unit, London School of Hygiene and Tropical Medicine. The new body, inquiries about which will be welcomed by Mr. Isaac, hopes to provide a forum where medical and non-medical men engaged in the practice of occupational hygiene or in research into its problems can discuss these together.

BYELAWS—concluded

4-point letter which was later conveniently forgotten.

(4) Final refusal was accompanied with a suggestion not founded on fact which I have already quoted followed by a suggestion to the Local Authority to again do what had already been done.

Conclusion

During the time at my disposal I hope I have given to you in a reasonable form evidence to show that in the case of my own Local Authority there is need for byelaws to control smoke emission from industrial undertakings. This need is not recognized by the Ministry of Housing and Local Government but instead the Ministry has adopted an attitude of obstruction by its refusal to grant the application.

Anyone who has taken day to day observations of many industrial chimneys will not deny the fact that much has yet to be done in the fight towards a cleaner atmosphere. Anyone who has had practical experience in the work of smoke abatement will support me when I say that most smoke emissions are capable of remedy and surely everyone will agree that a cleaner atmosphere and a more efficient use of fuel is a target which should not alone be that of the Local Authorities but of the departments of the Ministries also.

SALE OF PUBLICATIONS

Readers are reminded that any of the publications reviewed in this journal may be purchased direct from the Society, which is recognized as a Bookseller. Postage must be included where necessary.

Coke-Burning Appliances - Solid Fuel Usage - Fuel Research - the Alkali Works Report

Pressure on space prevents us from reviewing the following publications at the length we should have liked to give them, especially as each has features of unusual interest to readers of this journal.

Coke-Burning Appliances Handbook (Gas Council, 12s. 6d.) is an entirely new edition of a most useful work of reference. With 246 pages, printed on art paper with numerous illustrations, and strongly bound in cloth, it is, to begin with, good value for the money. It first deals in a direct and practical way with the efficiency and selection of open fires and heating stoves. There are then four pages of technical data on coke, and then the main section of the work, which is a list of approved coke-burning appliances, classified under the following heads: open fires, heating stoves, small domestic boilers, large domestic and small central heating boilers, and free-standing cookers.

Relevant British Standard specifications are listed, and there is an alphabetical list of the firms manufacturing the various types of appliance.

A Survey into the Domestic Use of Solid Fuel and Solid Fuel Appliances in Great Britain is an important report published by the Coal Utilization Council at 6s. It contains many facts and figures of value to those concerned in any way with the use of solid fuel, or the habits and attitudes in this field among the British people. It is based on interviews with a selected sample of 2,050 housewives, chosen on principles that today make it possible to obtain a nation-wide survey from a very small sample.

We can mention only one or two of the numerous facts that are recorded. Thus coke or Coalite is used in 18 per cent. of homes, the figure rising to 34 per cent. in the highest income groups and declining to 13 per cent. in the " working " class. In 34 per cent. of post-1945 houses it is burnt in the main living-room. 41 per cent. of households live mainly in the living-room. Six per cent. keep a fire in regularly all night in winter, and a further 13 per cent. do so occasionally. (The survey was made in early 1952). Eighteen per cent. of homes at that date had at least one modern appliance.

Hot water, cooking, fuel storage, needs, knowledge of new appliances—these are some of the many other factors discussed on the basis of the replies given to the investigators.

The 89th Annual Report on Alkali, etc., Works, for 1952, by the Chief Inspectors (H.M.S.O., 2s. 6d.) is, of course, concerned entirely with problems of air pollution, even though some are confined to specific local processes. Many however, are problems that are encountered more widely and much attention is paid by the Alkali Inspectors to processes not registered under the Alkali Act. There are, for instance, discussed in the report the problem of burning colliery spoilbanks (the general position of which shows little change), the prevention of grit emission from electricity generating stations, smoke from steam raising plant and from industrial furnaces, coke ovens, gasworks, dust from lime burning and stone-crushing, and so on. Among the registered processes pollution from cement works receives much attention in the report.

The Alkali Works reports are so

informative and so many different processes and subjects are discussed that it would be most useful, particularly where they are retained for permanent reference, if an index could be included.

Fuel Research, 1952 is the title of the report of the Fuel Research Board, with the report of the Director of Fuel Research (H.M.S.O., 2s. 6d.). Nearly all the work done at the Fuel Research Station has a bearing, direct or indirect, on the solution of the problem of air pollution. Not only is the prevention of pollution actively sought (as in further work described on the smoke eliminator door, now for use with the Cochran boiler), or its presence investigated and measured (further progress in the organization of which is recorded), but there is the research into new forms and new uses of fuel. There is also important extra-mural work sponsored by the Board, and of particular interest is that on smoke abatement in metallurgical furnaces being carried out in the University of Sheffield.

The Gas Council has published an excellent brochure on **Gas and Coke in Housing for Special Purposes** (price 2s.). This is to help to meet the housing needs of particular classes of people—in residential hostels, homes of various kinds, and also in self-contained homes, such as for old people, single workers, nurses, and so on. Most of the numerous illustrations are of installations actually in use in the homes described.

From our Photo-Library, No. 18 *Ashton-Under-Lyne Reporter*

AFTERMATH OF FOG

WILLENHALL SMOKE ABATEMENT ADVISORY COMMITTEE

by H. E. T. Lowbridge, M.R.San.I., M.S.I.A., Hon. Secretary

The Willenhall Smoke Abatement Advisory Committee came into being late in 1946 as it was felt that on the part of manufacturers and public alike there was a tendency to accept as inevitable the presence of smoke. The immensity of the smoke problem of this district can only be understood by considering something of its history and its development.

In common with most towns of the Black Country, its development to meet the needs of industry during the last century was rapid. It was a characteristic feature that houses were often built with a workshop in the yard at the rear for the making of keys as part of its major industry of lock making. With the introduction of mechanization many of these small factories, where keys were made by hand, were closed and the industry became part of the process of lock making in the larger factories. These small factories were not demolished but remained and in the course of time have become occupied by industries of varying descriptions some of which are capable of giving rise to smoke nuisances. It can easily be imagined that with development such as this until the district has 330 factories of diverse descriptions, and a population of 30,000 and an acreage of 2,834, the co-operation of everyone is essential if nuisances are to be reduced to a minimum. With many industries too involving processes in the " exempted " class of smoke legislation, the need for a co-operative approach to smoke abatement is even more necessary.

The Advisory Committee was formed of 15 manufacturers' representatives, and the Health Committee of the Council appointed the Chairman of the Health Committee, the Vice-Chairman, the Clerk of the Council and its Senior Sanitary Inspector to serve on the Committee.

The Advisory Committee appointed the Chairman of the Health Committee as its Chairman, and the Senior Sanitary Inspector as its Honorary Secretary.

There was and is no intention of the Council to usurp its Statutory obligations with regard to atmospheric pollution; the Health Committee of the Council did, however, appreciate at the outset that there were many technical problems involved in securing a reduction in pollution, and that by encouraging a free exchange of views between technical representatives of industry and Council representatives a mutual understanding upon some of the difficulties could be reached.

There can now be detected a greater appreciation of the need for a cleaner atmosphere than there existed a few years ago among the public, including employers and employees. The Advisory Committee has undoubtedly helped to bring this about although other factors have, of course, contributed.

Classes for stokers have been arranged during the daytime and the employers have co-operated in making this possible without financial loss to the employee; experts upon pollution problems have given advice to the Committee, and the Committee serves as a very useful medium for the spread of propaganda.

The Council installed during 1949, at the suggestion of the Advisory Committee, a deposit gauge in the Market Place and eight lead peroxide gauges in various parts of the district. In addition, the largest manufacturers in the district installed and operate at their own expense a lead peroxide gauge, a deposit gauge and a smoke

(*concluded on page 42*)

A Paper read at the Galashiels Conference of the N.S.A.S. Scottish Division, May, 1953

Smoke Elimination and Fuel Saving in a Brewery

by J. Dryden Little

Chief Engineer, Wm. McEwan & Co., Ltd. Edinburgh

Mr. Dunbar, our Smoke Abatement Chief in Edinburgh, asked me to try to make the contents of a paper I read in April of last year to the Scottish Fuel Economy Conference of interest to those whose energies are devoted to smoke abatement and the following is my attempt to comply with his request. It is a "virtue rewarded" story even although the virtue was of necessity.

I propose to describe the position in one of our Edinburgh premises as it existed prior to 1st January, 1951 with special reference to the plant and more particularly the smoke producing items, describe in detail the item which caused most trouble in this respect, comment very briefly on our new plant and methods, and finish with a statement on smoke abatement, improved efficiency, fuel saving and saving in £ s. d.

Up to the end of 1950 and partly during the first half of 1951 we burned fuel in many different places and in almost all cases with great inefficiency and often with the emission of much smoke. We did not do this due to carelessness or negligence but by carrying out our business in the age old accepted method.

At the premises in question—our Brewery and Bottling Hall, we had two 27 ft. by 7 ft. 6 ins. handfired Lancashire Boilers on natural draught. The load on them fluctuated abnormally and at times almost instantaneous jumps from say 5,000 lbs. of steam per hour to an output of 10,000 lbs. of steam per hour took place. When any process was in hand we never had enough steam and with the fluctuating load and inadequate steaming capacity our men were frequently led into over-firing with the resulting incomplete combustion of the gases. I estimate our thermal efficiency here never exceeded 55 per cent.

We had also three large rectangular heating tanks, two for Brewing Liquor and one for Cask Steeping Water. Each tank had a capacity of 35,000 gallons, was 30 ft. long by 15 ft. wide by 12 ft. high and was fitted with two furnaces of a design and arrangement probably rather inconducive to proper and complete combustion.

The thermal efficiency of the two Brewing Liquor Tanks varied from 45 per cent. downwards due to the quickly formed layer of spongy white lime deposit on the furnace tubes which could be from ½ inch to 1 inch thick in say one week. When the outside of the furnace tubes were limed up in this manner our men could scarcely avoid forming smoke in their efforts to meet the required temperature and output from the tanks.

The 30 ft. by 8 ft. Lancashire Boiler at the Bottling Premises was hand fired with coke breeze—a war time necessity—and had to be blown with forced draught. It was hopelessly overloaded and forcing the fires just blew fine grit out of the 100 ft. high chimney. Our roofs and roof gutters, rhones and the like had to be cleaned off very frequently within a radius of say two to three hundred feet.

Incidentally our handling of fuel had become shockingly expensive.

Before the war coal was shunted in rail wagons up a tunnel under our premises, raised in an elevator and sent by chutes to the various furnaces. During and after the war we could no longer get the 7 to 8 ton wagons we needed and we could not heighten the tunnel roof or lower its floor. All fuel had, therefore, to be delivered to bins at the West End of the premises and be carted from them all day and every day to points up to almost half a road mile away as in no case was there storage space beside the existing furnaces.

Finally we had six fire heated wort coppers—the worst offenders so far as smoke formation was concerned. Although we had these domed specially their thermal efficiency was only 47.5 per cent.

The combination of smoky emissions from the furnaces of all these items of plant built up to quite formidable proportions as all but the Bottling Hall boiler vented through the Brewery chimney.

A Brewery copper or wort boiling copper is nearly always made entirely of copper and the accompanying photograph and diagram show a typical scotch copper fitted with a dome to make it into a pressure copper for efficiency purposes. It is like an enormous egg dented in at the bottom.

Fig. 1 shows the type of copper we had before we steam heated and Fig. 2 how we altered it by fitting a steam heater and coil.

The fire heated copper had a wide skirted fountain resting on short feet on the inside of the bottom. The maximum heat from the fire is transmitted through the lens shaped or dented-in bottom causing a violent boiling and heaving motion resulting in an upward surge through the fountain forcing the wort to strike the baffle and be spread out to form an umbrella of moving wort at the top. Wort is the sweet malt flavoured brown coloured extract obtained from the malt in the mash tun which when finally brought into association with yeast is converted into beer.

The flame and hot gases lick the bottom of the copper, pass through the ports in the brickwork and go round the circular flue before passing out to the main flue and chimney.

The Steam heated copper has in our case a circular drum on long legs resting on the inside of the copper bottom, surmounted by a fountain and baffle. The circular drum has vertical tubes welded into it through which the wort passes upwards due to thermal action as in the fountain of the fire copper. Steam is led into the drum through one leg and the condensate is taken out through another leg. There is also a steam coil round the periphery of the bottom to ensure there is not a dead or cold, unboiled region in this area.

I would like to describe one or two of what I believe to be the causes of the formation of black smoke at *our* fire heated coppers.

These coppers are about 14 ft. diameter and run up generally to 90 or 95 barrels and in boiling evaporate down to about 80 barrels, a barrel being 36 gallons in our

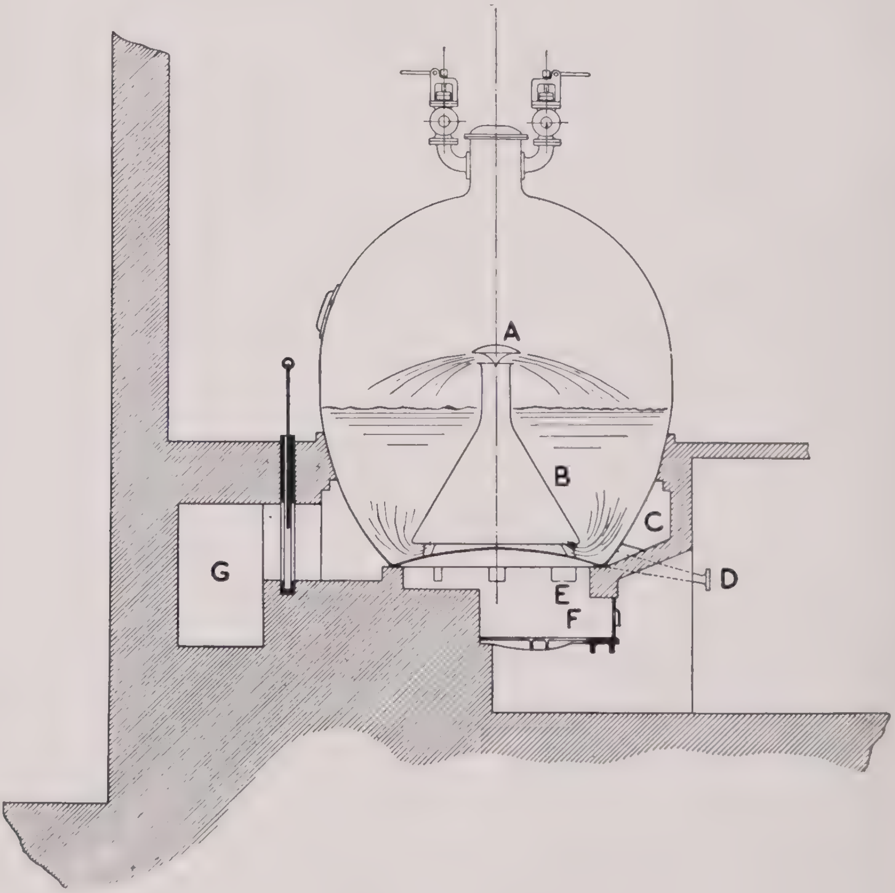


Fig. 1

FIRE HEATED COPPER

A—Baffle
B—Fountain
C—Circular flue
D—Wort outlet from Copper
E—Ports to Circular Flue
F—Furnace
G—Main flue

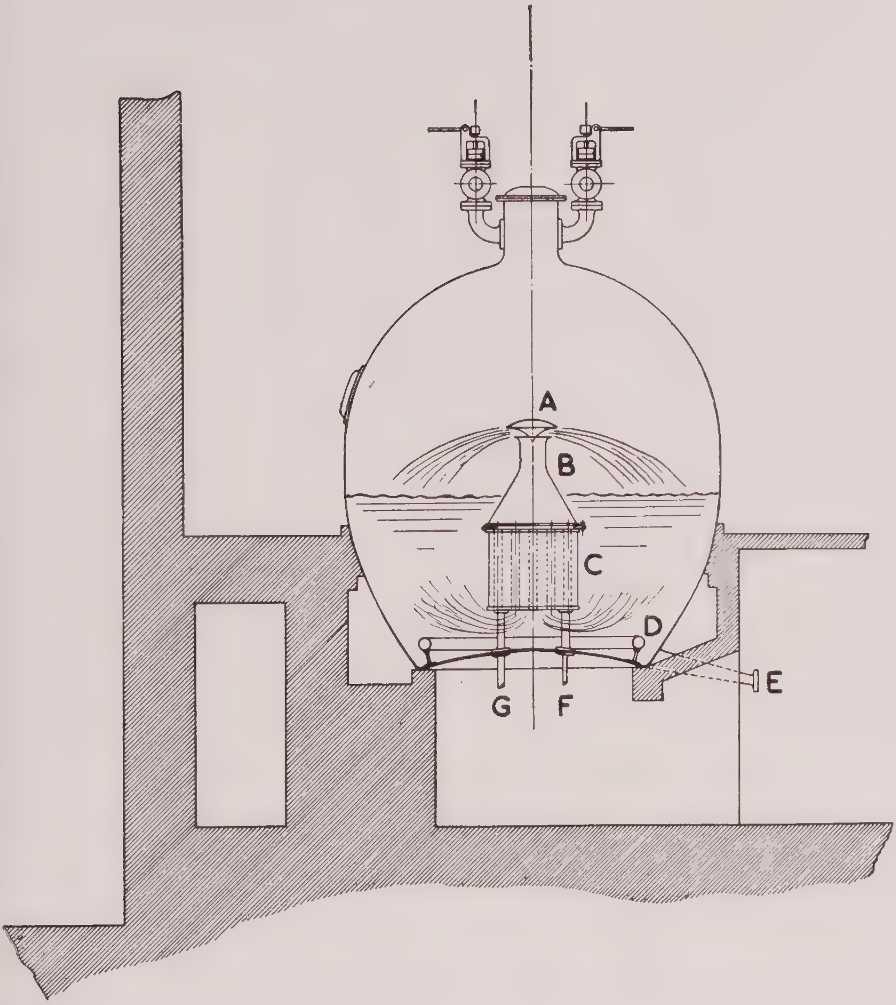


Fig. 2

STEAM HEATED COPPER

A—Baffle
B—Fountain
C—SteamHeater
D—Steam Coil
E—Wort outlet from Copper
F—Condensate out
G—Steam in

trade. In our programme we cast a copper every hour in winter and every 50 minutes in summer working night and day from Sunday night to the following Saturday at say mid-day. This means that every 50 minutes (or one hour in winter) we kindled up a new fire under a copper. To keep to time table and keep up our output we had to rush the copper to the boil immediately and then boil very vigorously. This meant that every 50 minutes we started up a green fire in cold brickwork against an almost cold copper, hence for the first say 15 minutes black smoke was emitted copiously.

Everything is cold at the start as the fire must be drawn when the previous charge is cast. There is a gummy layer deposited on the inner surfaces of the copper and this would bake into a hard scale, difficult to remove and also the copper itself would waste away quickly if the fire was left even smouldering below it.

To cleanse the copper before the next charge it has to be entered by a man with scours and a hose immediately it is cast and while the deposit is still soft. To allow of this not only had the fire to be drawn but the incandescent furnace brickwork had to be hosed to make the inside of the copper sufficiently cool.

I might say that the brickwork in such coppers is not sufficiently or suitably placed in my estimation to give a nice large hot mass against which the smoke would impinge to ensure proper and complete combustion of the volatiles from the fuel. I find it rather difficult to think of a better way to arrange the brickwork setting and flues to give this hot mass.

At our Brewery bituminous coal with a high volatile content was favoured because of the long flame obtainable.

It would be reasonable to ask why we did not steam heat before and get rid of the black smoke, inefficient consumption of fuel and enormous expense of repairing furnace brickwork etc. and why very many breweries still have fire heated coppers. I will try to give you one or two reasons for this.

First of all you boil the wort to sterilize it, to extract the flavour and keeping qualities from the hops, to concentrate the wort, to give caramelization of sugars in dark worts and to give a coagulation of the protein matters.

To bring about these ends brewers contend a very fierce heat is required and they have pointed out the temperature in a furnace might be 1000-2000°F. but only 240°F. in the steam and that because of this they must have a coal fire. Very many still make this claim.

It is no argument to say that you just can't raise the liquid, wort in our case, above its boiling point no matter the heat that is applied to the outside of the vessel containing it. There is much more in it than that.

The Wolverhampton Bill

I wonder if any of you read the report of the proceedings before a Standing Committee of the House of Commons on 24th May, 1950 at which three Wolverhampton breweries appealed against Clause 87 of the Wolverhampton Corporation Bill. This clause prohibited the emission of smoke in their proposed smokeless zone.

They argued with the aid of several brewers and learned authorities that the fermentation following a boil in a coal fired copper is definitely superior and that the yeast produced during that fermentation is superior. They said the naked fire gives a better coagulation due to the greater thermal shock, there being a greater difference in temperature between the outside and the inside of the fire copper than that between the steam side and the wort side of the steam heater and they also contended the flavour of the beer was altered to some extent with steam heating. They pointed out that a customer developed his preference for a certain beer on palate above all else and that to change to steam heating might materially affect their trade.

Though the petition was not successful in the House of Commons, the arguments outlined above were accepted by the House of Lords and a clause was inserted in the Bill protecting the three breweries from the operation of the Corporation's powers to create " smokeless zones " in the town.

I think there is probably quite a lot in the brewers' arguments. These brewers like the frying or the " jump " of the wort off the bottom of the copper when boiling and I think there is no doubt the inside surface of the copper bottom is hotter over a naked fire than the surface of a steam heater. Dr. Slator and Mr. St. Johnston claimed in 1947 that over a bright fire the inner surface of the copper could be 252°F. and Lloyd Hind, one of the greatest authorities on brewing in recent years, records a temperature of 266°F on the inside of a copper bottom whereas the wort side of a steam heater even with steam at 70 lbs. per sq. inch (a much higher pressure than is usually used) was only 230°F. From what I have heard and read it seems to me to be quite conceivable that this greater temperature over a naked fire could make with certain types of beer a considerable difference and might well result in partial caramelization of the wort giving—and here I quote—" Superior flavour and palate fulness." Some brewers speak of this sort of super heat as giving a slight singeing to the wort.

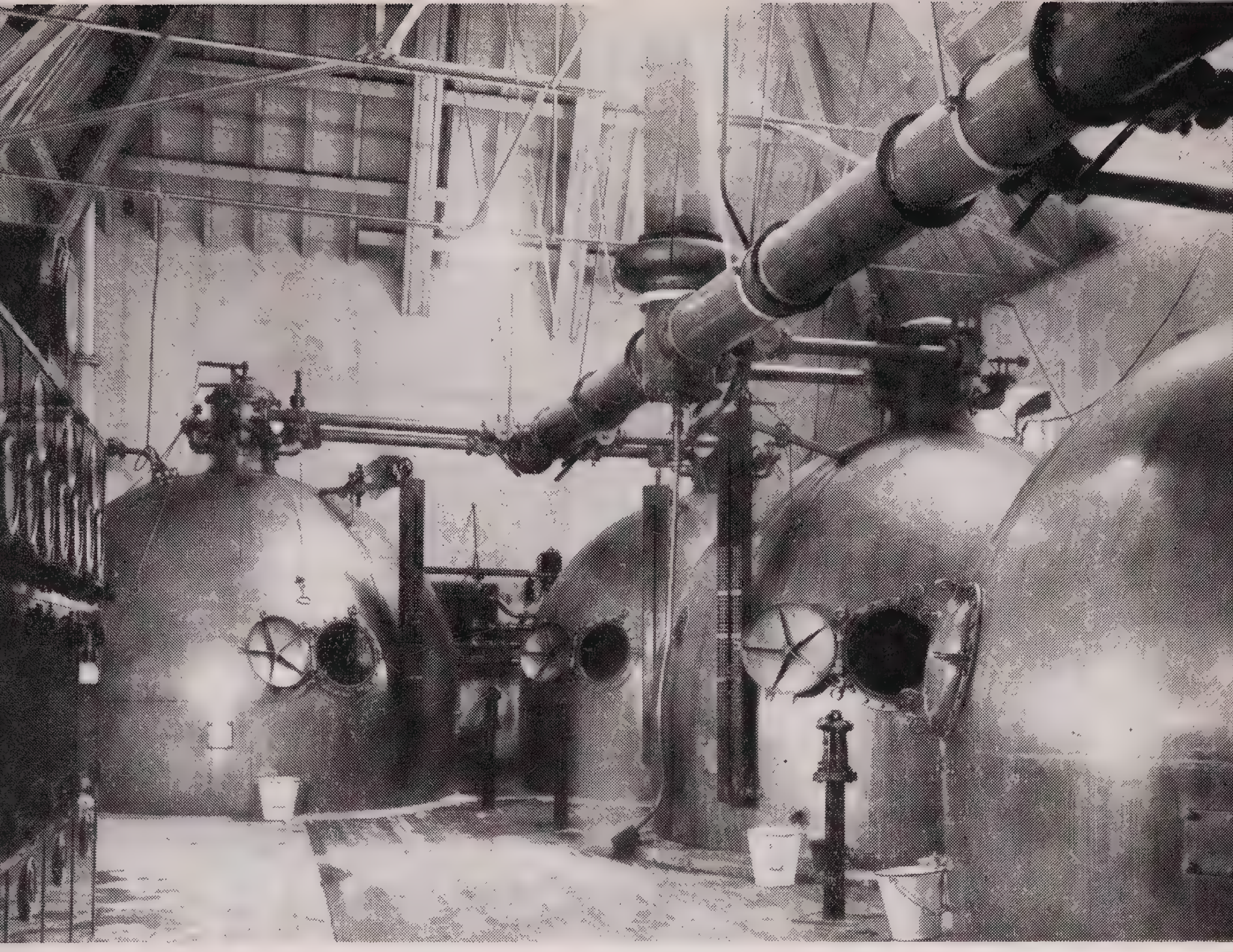
I have also heard it said that the difference between steam heating a wort copper and fire heating a copper is rather similar to roasting a bird in a gas oven and roasting one on a spit before an open fire. However, there is no doubt that south of the Border many brewers who have had experience of both open fired and steam heated coppers are firmly convinced that the fire heating gives certain characteristics to the beer which the steam heating does not and they contend this is much more pronounced with the higher gravity beers and with the non-pasteurized and non-chilled and filtered draught beers.

Please remember brewing is not an exact science. There is much skill and craftsmanship involved and generations of experience have been handed down from brewer to brewer.

You will appreciate that any change which might in any way alter the type or flavour of the beers being brewed by a Company is of enormous and fundamental importance and I think there is no doubt that certain factors such as the local conditions, materials used, type of beer being brewed and even the brewing liquor, i.e. the well water, would have a bearing on whether or no a change from fire heating would have an effect on the finished product.

These, therefore, are, I believe, some of the reasons why all brewers do not adopt steam heating. Another reason might be the high capital cost of the change over if the existing boiler capacity could not cope with the additional steam load and also the possible lack of space to accommodate an increase in steam boiler plant.

However at Fountain Brewery we felt our plant as a whole was old fashioned in operation and due to circumstances often



A Corner of the Copper House, showing four of the seven Steam Heated Domed Coppers

beyond our control, we were being forced to adopt cumbersome, inept and expensive methods of work while fuel consumption and smoke emission were getting out of hand.

We went into the matter very fully. I was sent to other breweries to investigate and report on new types of steam using plant and the steam heating of coppers and finally we installed a seventh copper and fitted it with a steam heater and steam coil.

By starving other processes and staggering loads we found enough steam to carry out some experiments. We did, I admit, fit rather an oversize heater and coil to be on the safe side. We obtained a very vigorous turbulent boil, really excellent control and level temperature during the whole boil, not a rise and fall as the fire burned brightly or died down. Our tests were entirely satisfactory. It so happened that the flavour, brightness, keeping quality etc. of our beers were not impaired in any way we could find. Probably because of the types of beer we brew but—and here the Engineer speaks it—may be just our luck.

So we decided to go ahead and install a new steam generating plant and carry out all our processes with steam heat which entailed two or three large new buildings and very much new process and steam using plant at a total cost of well into six figures.

The Boiler Plant

In connection with the boiler plant itself we took what proved to be two very wise steps at this time. We appealed for aid, advice and guidance from Sir Patrick Dollan, Chairman of the Scottish Fuel Efficiency Committee, and his Staff Officer, Mr. Edward, and, so far as the boiler plant was concerned, we put ourselves unreservedly in the hands of one well known Glasgow boiler manufacturer.

In our negotiations—battles would be a more correct word—to obtain licences and to re-acquire a building licence for the boiler house that was withdrawn during one of the austerity drives of Sir Stafford Cripps, Sir Patrick's Department gave us very great help indeed and, regarding the second step, we have never regretted refraining from obtaining competitive schemes and offers for the Boiler Plant. The Boilers and their ancillary Plant have been a complete success and the after sales service, advice and attention we have had from the Director and

General Manager of the Boiler Company have been beyond praise.

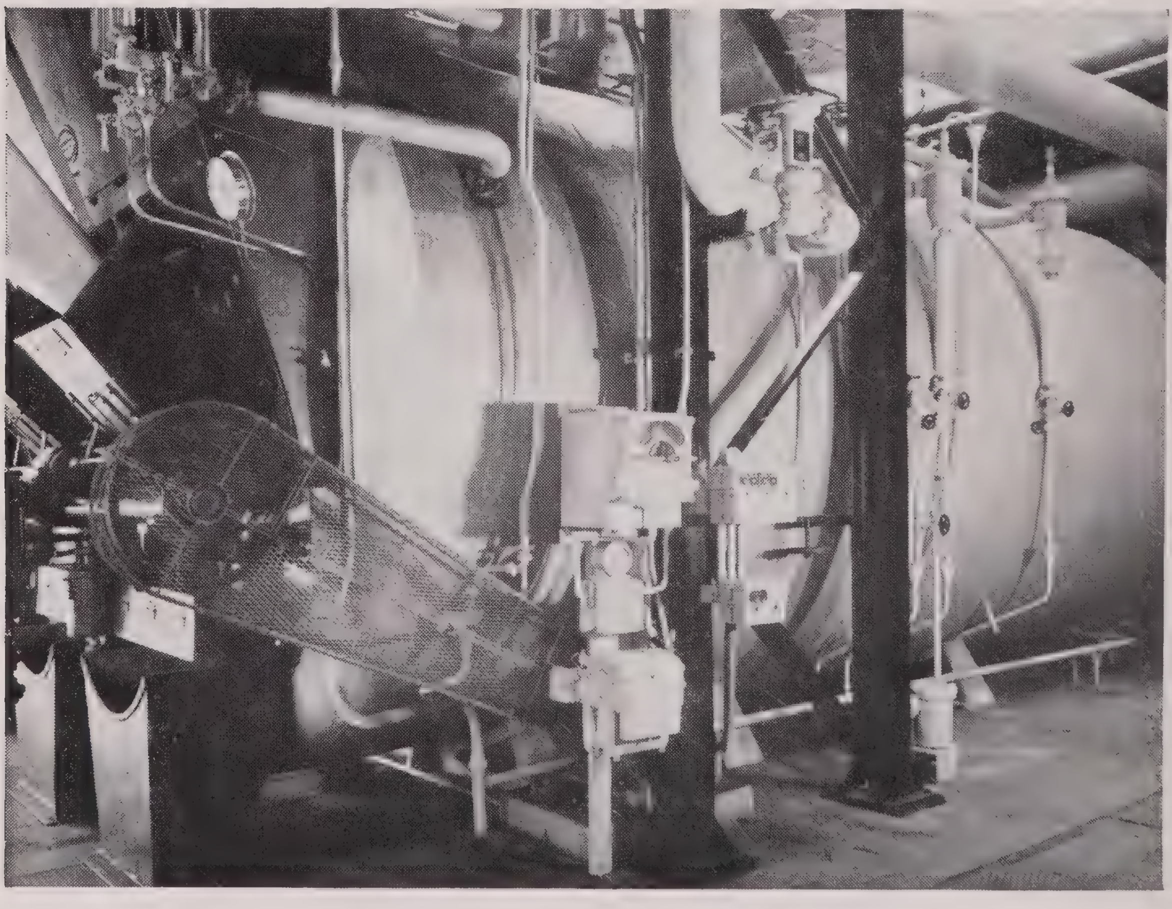
We finally put our boiler plant into operation in January 1951 and the last of the new steam using plant was in use by July of that year.

The new Boiler Installation has been located at the west end of the site where, in the open yard, we have space for it and where the coal dust and chimney emissions —now almost negligible—are as far removed as possible from the points at which our product is most vulnerable.

We laid in a new railway siding to serve the intake hopper when we wish to take our fuel by rail and the coal bins, previously so remote from the points of consumption, are now right up against the boiler house.

Let me make it quite clear that we have gone over wholly to steam heating for all our processes and have given up every other coal fired item in the premises. We have no longer any double handling of coal in the ordinary run of our work. We are accepting our deliveries by road meantime and the coal is simply tipped straight into the intake hopper. We felt a change to a more efficient type of boiler could be justified as, out of the many firemen we had, we felt we could pick a competent and reliable squad. We planned for four boilers—three to be in service and one to be off for rotational cleaning and to act as a standby. We built our new boiler house with a temporary wall of R.P.M. sheeting at the south end so the building could be extended and we placed the boiler house so there is ample room for this extension. We had the chimney, ducts, conveyors, elevator, hopper, feed pumps and tank etc. designed to serve six and not just four boilers. Our plant is very simple and straightforward but some of those present might like to know of what it is comprised.

We have 4 Economic Boilers with built in combustion chambers. They are 16 ft. by 10 ft. 6 in. for 12,000 lbs. of steam per hour each, at 120 lbs. per square inch. We have Hodgkinson's Coking Stokers, Lee Coal Meters, Green's Diamond Economisers, Davidson'sInduced Draught Fans and Davidson's Grit Arrestors. We have Clyde Soot Blowers for the Boiler Tubes and also for the Economiser Tubes. All Boiler Mountings are by Hopkinson except the Ronald Trist Thermofeeds and Hilo Alarms. The ashing plant by John Thompson is very



Side of one boiler, showing Ronald Trist Hilo Alarm and Thermofeed, Regulator for 1D fan and stoker and ash chutes

satisfactory and saves much dust, labour and cleaning up.

Perhaps a word of description here might be of interest as it was originally designed by someone you probably all know, namely Mr. H. E. Partridge, when he was a young draughtsman in Messrs. John Thompson's Wolverhampton Drawing Office.

The ash is drawn along the ash pit to the boiler front by a long handled shovel and is dropped down a chute with abuts on the furnace front, any dust so caused being drawn back into the furnace by the induced draught.

The chutes pass through the floor and discharge on to a rubber conveyor band submerged in water in a long cast iron trough. When cleaning fires this band creeps along and discharges into another but inclined conveyor at right angles which as you will later see empties the ash etc. into an overhead hopper for convenience in loading into road vehicles.

This reduction in dust and dirt is so marked that the boilers and equipment painted almost white well over 2 years ago are still remarkably clean and the boiler house floor is always almost clean enough to eat off.

We log readings of almost everything, every hour and we summarise all these 24 hourly readings and calculations in a weekly log sheet which covers from Sunday a.m. to Saturday p.m. This ensures our weekly thermal efficiency and cost figures are worth while as they take into consideration the lighter loads at night and partially banked periods at week-ends etc.

The long steam distribution system which we swithered over so much has been quite successful and the steam is distributed by a 10 inch diameter main at 120 lbs. per sq. inch. This main travels for about 1,500 ft. or more through the premises and off it are taken branches to the various departments. By the insertion of steam driers on the pipe line and by reducing the pressure at each point of consumption, the steam as used is reasonably dry.

Each boiling copper is fitted internally with the steam heating unit and coil I have described and all brewing liquor and cask washing and steeping water is passed through special calorifiers to heat it.

We take back by pipeline most of our condensate, in fact, as much as we can conveniently use. Our feed tank is always at 160°F. to 170°F. but we actually put the feed into the boilers at 320°F. about 30°F. below the critical temperature as, of course, ours are not steaming economisers. We also installed a new cask washing plant made possible by the new and ample supply of steam.

The Rewards

In a brief manner I have described the old plant and the new plant and now I would like to indicate to you some of our rewards for all this expense and work which had to be carried out, and was carried out, in such a manner as not to interfere in any way with the output of the Brewery.

At our now one and only coal fired plant, the economic boilers, the thermal efficiency for the 12 months ending 31st December, 1952 was 75.88 per cent. and during weeks where loads and been suitable 76 and 77 per cent. were common.

Two 8 hour tests carried out by outside experts and during quite average day loads gave a thermal efficiency of 82 per cent. *Black smoke has really been completely cut out.* There is usually just a thin grey wisp from the chimney. The only time you see more is during the one or two minutes in each shift when the soot blowers are operated and the grit arrestor plant just cannot quite handle so much in such a short space of time.

To return to the wort copper for a moment—the net thermal efficiency has risen now they are steam heated—from 47.5 per cent. to 66 per cent.

Let me now give you the actual saving in tons of fuel.

The average annual coal consumption for the years 1948, 1949 and 1950 i.e. the three years before we started to put this new plant into use was—13,812 tons.

The actual fuel consumption for the 12 months ending 31st December, 1952 was 9,809 tons.

Hence the saving for the 12 months period was 4,003 tons or 29 per cent. in spite of the beer output (i.e. gross bulk barrels brewed) in the 12 months of 1952 being 7½ per cent. up on the average for the years 1948, 1949 and 1950.

This 4,003 tons per year or 29 per cent. is a pretty fair saving to make but it irritates me to know we could have boasted a saving of easily 34 or 35 per cent. if we had not to take on steam loads just as we started up the new boilers, which loads never existed in any form in 1948-1949 and 1950—such as an entirely new and extensive space heating system, and the heating of all Brewing Liquor, approximately 500,000 gallons per week to say 40°F. higher than ever before etc. etc.

I would like to finish with a general comment on costs.

The annual saving in fuel alone is £11,446 and this would replace in 9¼ years' time the capital expenditure in the boiler plant and ancillaries: the chimney, the boiler house etc. and the foundations which were very expensive due to water and running sand, plus the architects' fees (but not fees to Engineers as we did not employ a consultant).

Another way of putting it is that this fuel saving alone would replace the cost of all the above plant and building etc. **plus** steam-using plant, new cask-washing plant and building to house it, calorifiers, controls, etc., i.e., all our new plant and buildings in approximately 14 years.

You will note the foregoing was on the basis of cash saving effected by reduction in fuel consumption only. There is, however, the all-in aspect of the matter to consider.

The new system saves much internal carting of coal and ashes. It cut out so many scattered furnaces, it eliminated many firemen, three shift coalmen, carters etc. The new cask-washing plant saved men and coopering and the new system saved an annual expenditure of a few thousand pounds on brick work repairs at the coppers alone. Of course rates of pay etc. are going up and tending to spoil the picture, but allowing for fuel and manpower etc. saved and allowing for running charges of all new plant etc. we find a nett annual saving of £38,220, i.e., the cost of the whole scheme can be replaced in exactly 4¼ years.

I think that on behalf of my Company I should say at this point that Messrs. William McEwan did not pay off any of their men made redundant by these improvements, but found other work for them until they could be absorbed into different departments to make good the usual annual depletion caused by removals, deaths and the like.

Of course, due to the conditions obtaining in their premises not being the same as was the case in ours, other Companies who have not yet modernized on a large scale might not show such substantial savings.

I am afraid my talk has not dealt very largely with smoke abatement but I hope that in spite of this you have found it to be of some interest to you, and that it may help you to encourage firms to spend a little, to stop chimney emissions, because if they choose their method of so doing, they may well effect a concomitant and considerable economy in fuel consumption and running costs.

SMOKE AND THE LAND

An article in *The Farmers Weekly* of 3rd July was on one of the problems of the farmer—" The Smoke." It dealt largely with conditions in Lanchashire and one example given of the cost of smoke to the farmer was that for one progressive all-grass farm of 130 acres the fertilizer bill last year came to £1,000—more than twice as much per acre as is spent in the Holland division of Lincolnshire. On 4th August the *Farmer and Stockbreeder* carried an article on " Steep Slopes and Smoke "—two of the problems facing farmers in East Lancashire. Special reference was made to the work of the Ministry's Experimental Husbandry Farm at Helmshore, Rossendale, where a deposit gauge records 120 tons per square mile per annum—that of a small town. *Town and Country Planning*, the excellent monthly of the T. and C.P. Association published recently an article on "Trees for Industrial Localities," in which the serious effects of air pollution were described.

WILLENHALL—*concluded*

filter and volumetric sulphur dioxide apparatus for daily readings. For the three completed years in which the deposit gauge in the Market Place has been in operation, the average readings (total soluble and insoluble matter in tons per sq. mile) are as following:

1950 ..	31.21
1951 ..	27.39
1952 ..	22.64

The talk given by Mr. Southan* is an example of the service which the Committee can be in spreading knowledge upon a pollution problem; in addition, Messrs. A. J. Vaughan & Co. Ltd. gave an invitation to the Committee to visit the works to examine the apparatus under working conditions.

* It is hoped to include a report of this talk in our next issue—Ed.

Fighting Smoke in Bradford

A Survey of Twenty Years of Smoke Abatement Activity

by S. Clegg, A.M.I.Mech.E., A.R.San.I.

Mr. Clegg's interest in the subject of atmospheric pollution started during his seven years apprenticeship to steam boiler engineering, and continued when he became outside manager to a well-known firm of boiler and furnace makers. He was Smoke Inspector in the Public Health Department of the City of Bradford from 1920 *to* 1940 *and this article is based on his official experience.*

DURING the twenty years ending 1940, three Acts regulating smoke emissions were operated in Bradford. First the Bradford Corporation Act, 1910 and 1913, second The Public Health (Smoke Abatement) Act, 1926, then the Public Health Act, 1936. The Bradford Act was specially interesting, and contained some unusual provisions. It was an offence to emit any kind of smoke or grit that it was practicable to prevent, and the person having the decisive control of the furnaces in question at the time of the offence was liable to penalty: court proceedings were taken personally either against owner or occupier, engineer or stoker. This Act was based upon practicability, each case of excess smoke required immediate investigation, into furnace construction, the cause of smoke, and the person to be held responsible. To prove the cases in court it was necessary to produce evidence, showing: (1) the smoke emitted; (2) the cause of the smoke; (3) that the person charged had the decisive control of the furnaces at the critical time; (4) the practical remedy.

Much time and care was required to collect irrefutable facts and evidence, sometimes in face of abuse and obstruction. Court hearings were often lengthy, but the final results were encouraging. During eight years operation of this Act, until it expired, smoke offences were proved in court against 36 owners or occupiers, and 47 engineers-in-charge or stokers.

The indisputable results of the prosecutions definitely show that the Act was very successfully operated. The hardest task lay in finding the root cause of smoke, and the person responsible. At times it was only possible to commence investigation, after the observation of the smoke, when the condition that produced the smoke might have altered or disappeared, or one chimney might be disgorging the smoke from five or six boilers operated by an equal number of men. In such circumstances it was no easy matter naming the human sinner, and occasionally both employer and employee were successfully held responsible.

Time limit for black smoke

In 1928 a new national Act, The Public Health (Smoke Abatement) Act, 1926, and its related byelaw was adopted. This Act made it a definite offence to emit more than a total of three minutes black smoke in the aggregate, within a continuous period of thirty minutes. The local authority was required to serve a notification of the smoke emitted, and also an abatement notice; for not complying with the notice the maximum penalty was £50. This was the first time a definite legal time limit had been placed on black smoke emission; legally it was only necessary to show in court that the smoke was black, and emitted longer than the permitted period, and that notices had been served. For emitting grit or smoke other than black so as to be a nuisance "practicability" had to be considered. This Act with only little alteration was later incorporated in The Public Health Act, 1936, and the smoke sections of that Act are now in general use throughout the country.

The Acts compared

Comparable periods and results of operating the above-mentioned Act are not possible with the data available, which data was originally collected for technical educational purposes. During the decade ending 1930, 13,400 timed smoke observations were carried out, 1,390 (or 10 per cent.) of the chimneys were found to be emitting black smoke for more than a total of three minutes per half hour. Arising from these chimney observations, 83 prosecutions were instituted under the Bradford Corporation Act, and 17 under the Public Health (Smoke Abatement) Act, 1926. In these hundred proved court cases, the average period of black smoke emission amounted to 13½ minutes in thirty.

For the following years 1931 to 1938, 8,183 timed chimney observations were made, 1,233 works were visited where the smoke emission was on the verge of offence, and inspection made of boiler plant and operating conditions. In 390 of these visited cases, where the emission was excessive, abatement notices were served, the average period of black smoke emission was 6½ minutes in thirty. In 25 cases, where the abatement notice was not obeyed, prosecutions were instituted.

Examination of the case papers reveals: (1) that the recipients of abatement notices exercised much greater care in preventing smoke; (2) that follow up observations resulted in an average of only three court cases per annum, compared with 10 such cases under the private Act, where no abatement notice is necessary; (3) where the smoke emissions could be compared, the smoke output was reduced by half during the latter period.

Smoke Measurement

The fact that excessive pollution existed during the earlier years was indicated at a Ministry of Health Inquiry in Bradford in 1928, when official evidence was given that for the previous three years atmospheric deposits in an industrial district of Bradford amounted to 2,524 tons per square mile in 1925, 1,661 tons in 1926 and 1,523 tons in 1927. Later recorded deposits for some years before the war were about normal, and this showed that the determined efforts made to clean up the worst chimneys, met with success. The revival of such efforts may meet with higher rewards.

Causes of Smoke

There are many aspects of smoke causation, but this is an attempt to classify the causes in boilerhouse practice, by considering the 100 proved cases, along with the 349 cases of excess black smoke, subjected to investigation and abatement notice during the years 1931 to 1937.

The salient facts of this survey show that 74 (16 per cent.) of the excess smoke cases were due to lack of sufficient draught producing apparatus often at peak load periods. In the other 375 (84 per cent.) the excess smoke was very largely due to some form of careless or faulty operation, or negligent maintenance of boiler plant. The greatest cause of smoke, and the most easily preventable, was that due to heavy spread firing on hand-fired grates, it accounted for no less than 188 (42 per cent.) of the cases.

Summary of Experience

It can be well and honestly said that during twenty years operation of three smoke Acts, no insurmountable obstacle to successful operation was experienced in dealing with either black smoke, or smoke of other colour so as to be a nuisance. Successful court proceedings were also taken in regard to grit emissions, where the identity of the offending chimney could be established beyond doubt. In some grit cases, the grit was related to the class of fuel used at a particular works; but, if the grits were as much

Summary of Causes of Smoke—449 Investigations

	Cause	*No. of cases in 17 years*	*Percentage*
A	Spread firing by hand	188	41.9
B	Insufficient draught plant	74	16.3
C	Inattention to mechanical stokers	72	16.0
D	Defective condition of furnaces	29	6.6
E	Extra duties of fireman	25	5.6
F	Insufficient boilers in operation	15	3.3
G	Unduly restricted draught	11	2.5
H	Sundry causes	35	7.8
	Total	449	

A — Spread firing at long intervals, causing sudden cooling of fires below the ignition point of the volatile gases.

B — Insufficient apparatus installed for providing necessary air supply, particularly at peak loads.

C — Human element—neglecting to regulate the throw of the stoker shovels to suit the size or condition of coal in use, and occasional neglect to maintain propelling parts of moving firebars in good order so as to secure full travel of the bars.

D — Conditions arising usually due to wear over a long period and neglect to maintain mechanical stokers in good condition.

E — Boiler attendant carrying out other duties, causing furnaces to be neglected.

F — Not operating with sufficient boilers, or working the furnaces above their fuel consumption capacity, in efforts to reduce radiation losses.

G — Deliberate and undue restriction of air supply in efforts to obtain high percentage of CO_2 in flue gases.

H — Defective brick flues and settings, excessive raking of fires, dirty flues and boilers, etc.

alike as ocean sands and covered a fairly large area and within that area there were 40 or 50 chimneys each capable of emitting similar grits, it was found an onerous task to prove beyond doubt in a law court, the connection between the discharged grit with the defendant's chimney.

In nearly all smoke prosecutions, the magistrates wanted to know the cause of the smoke; if the information was not given by the Inspector, and supported by the evidence, the defendants, whether they pleaded guilty or not, invariably made some plausible excuse to prove their innocence. It was obvious that any difficulties encountered in operating the Acts were greatly reduced because the Inspector had a deep knowledge of both practical and technical operation of fuel burning installations and boiler plant, which enabled him to judge what was practical and to advise the works management and furnace operators, his authority and the magistrates.

A vigorous protest at the policy of the Ministry of Fuel and Power in encouraging the burning of poorer grades of coal by householders has been made by Westminster City Council.

Corby is reported (*Kettering Leader*) to want a swimming bath, but its hopes are at present poor—" because of air pollution an open bath anywhere near the centre of the town would be of little use on days when the wind blows from the direction of the works. A covered bath, costing more money, will be necessary."

LOW GRADE FUEL—*concluded*

so does the availability of residual oil suitable for boiler furnaces. There are no technical difficulties, and the economic aspects of the use of liquid fuel for steam raising is becoming daily more attractive in many areas.

A note on possible developments with oil-firing in relationship to smoke formation will therefore not be out of place. When oil fuel is used, it has long been appreciated that when once the design of the burners and furnace has been settled satisfactorily, a light haze at the chimney top is a sound practical indication of efficient operation. By reducing the percentage of CO_2 in the flue gases, this haze can be made to clear, but the efficiency of combustion is thereby reduced.

Sulphur Dioxide

In conclusion, the evil caused by the discharge of sulphur dioxide should never be forgotten. It does not appear as smoke, but can cause incalculable harm. The immediate surroundings of the boiler house may well be clear, but the trouble will be felt further afield. It is a matter for experts to decide whether flue-gas washing plant or alternatively tall chimney stacks provide the best means of mitigating the evil. It is a complicated subject, and opinion now seems to incline towards the latter solution.

The Directors' Report of Coalite and Chemical Products Ltd., for the year ended 31st March, 1953, includes a section on smoke abatement, in which reference is made to the retrograde introduction of unrationed slack, the London fog of December last, and the progress being made in the development of smokeless zones.

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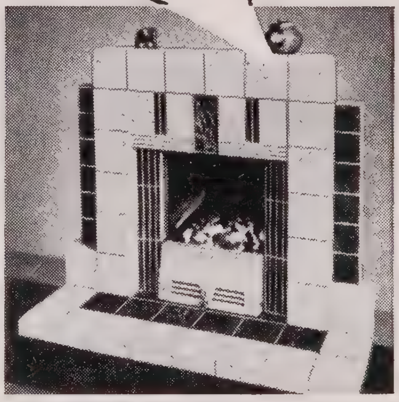

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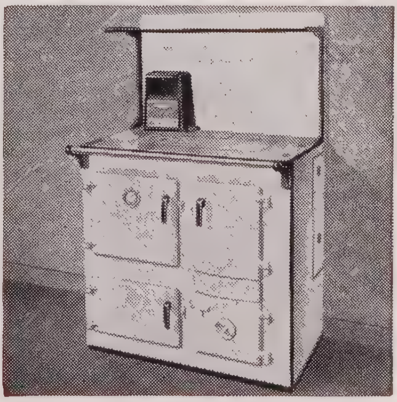

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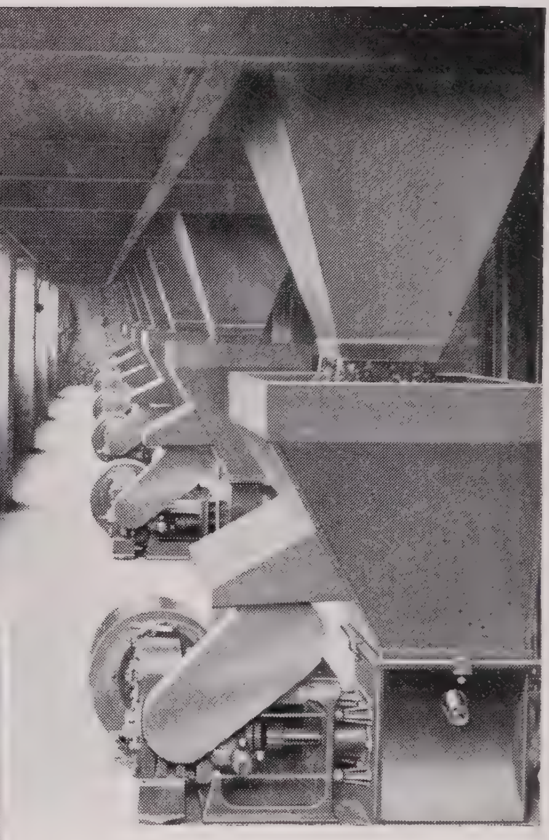

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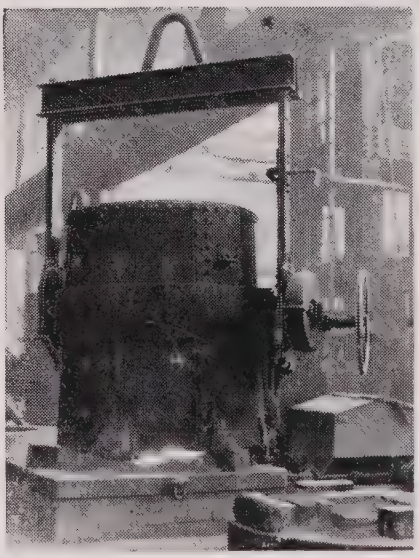

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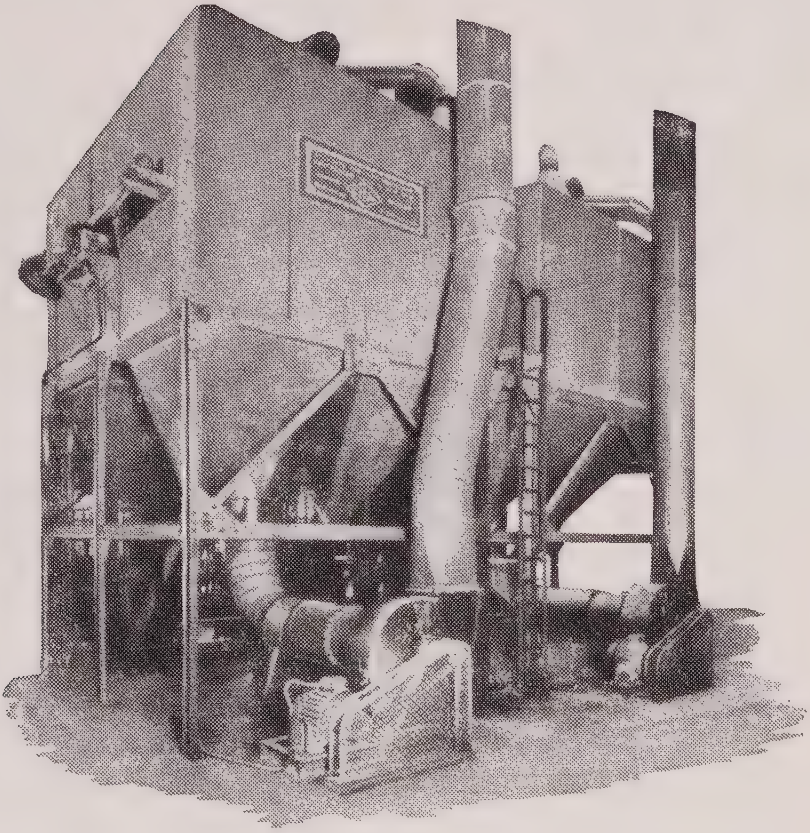

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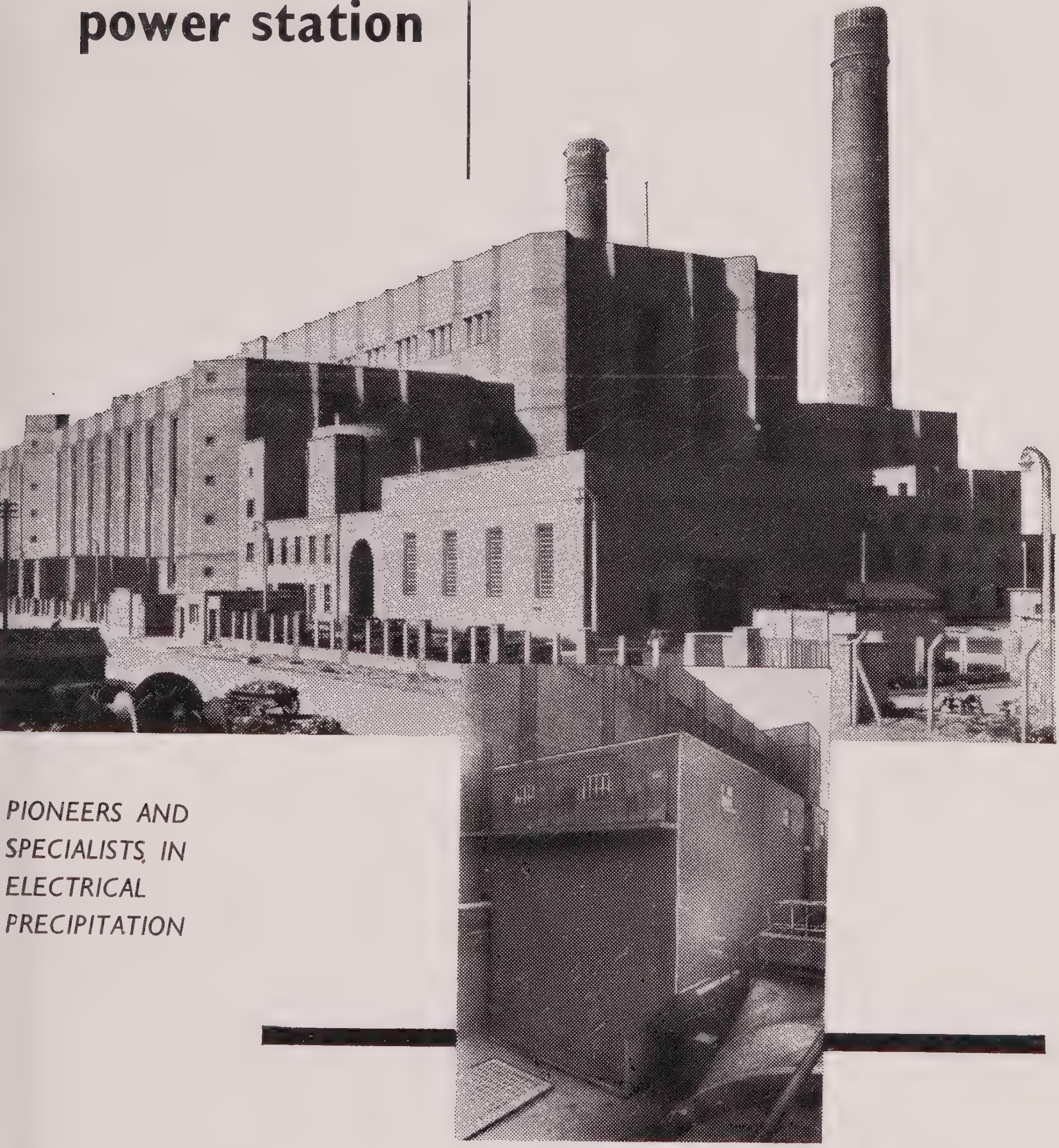

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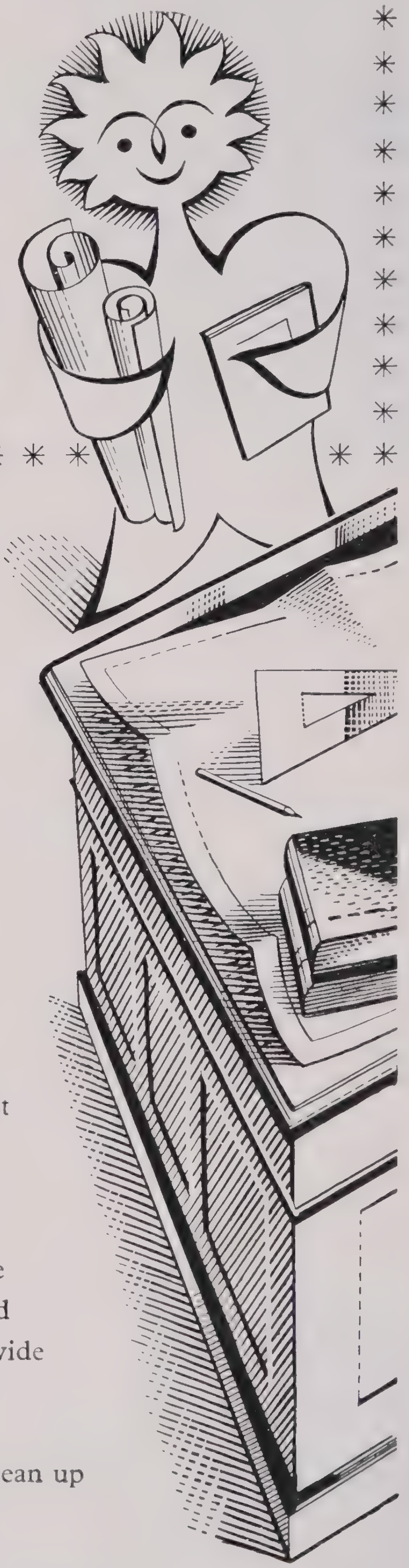

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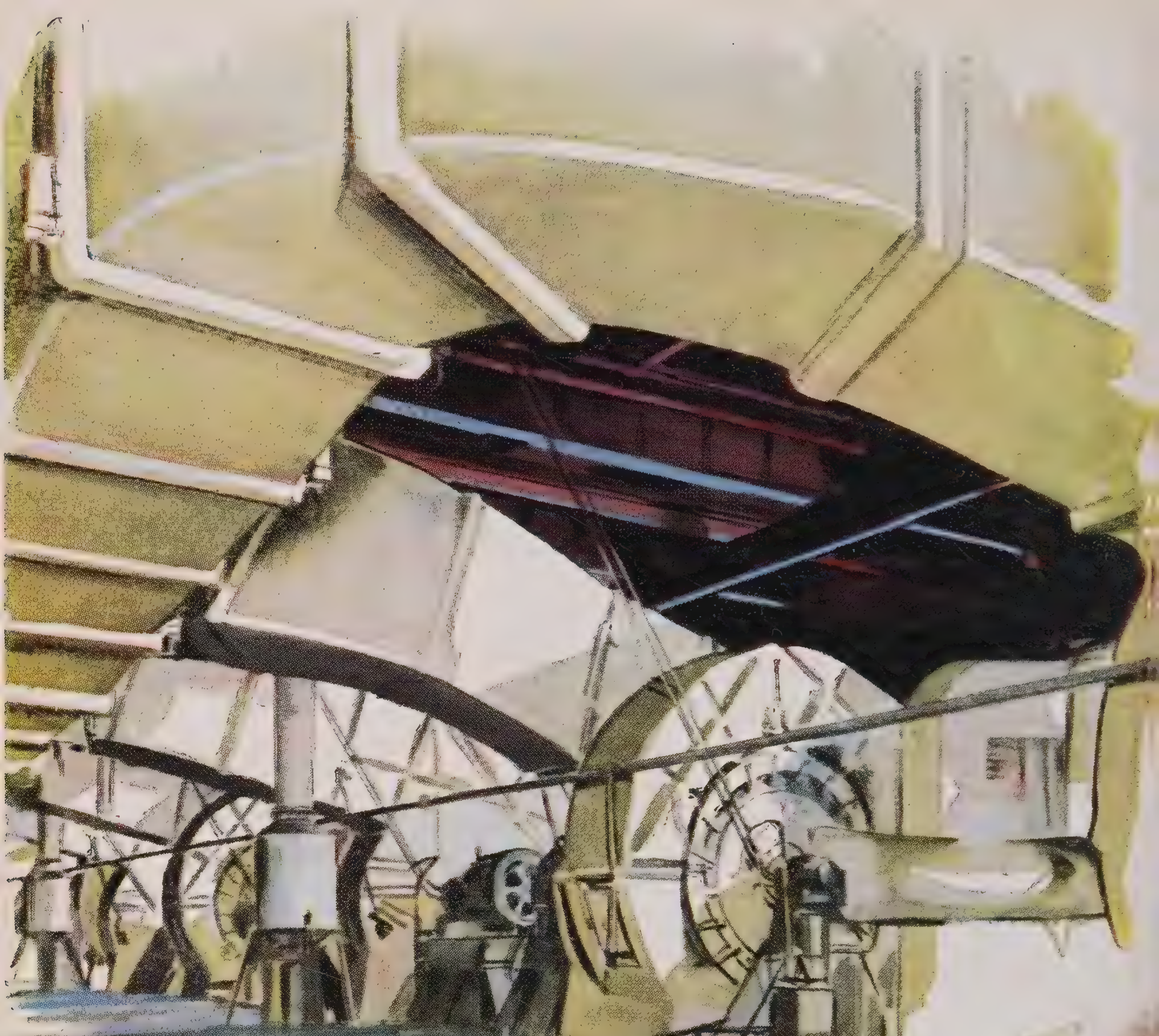

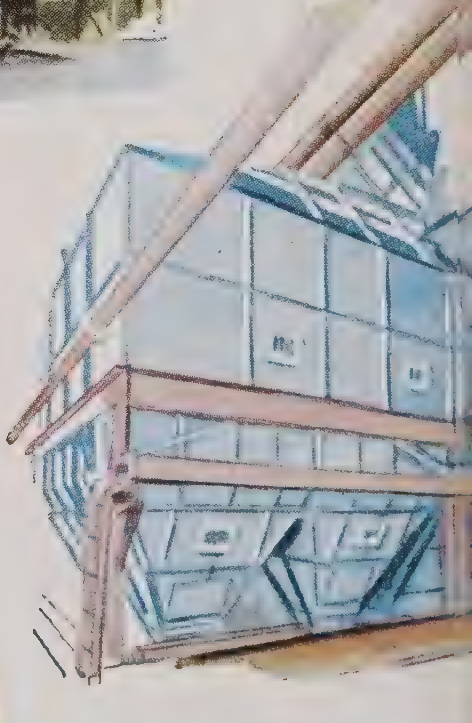

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SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL

No. 88 WINTER 1953

ONE SHILLING

In this Issue

The Melchett Lecture, by Dr. Harold Hartley
A Chadwick Lecture, by C. J. Regan
U.S. Association's Membership Growth
A Spate of Meetings
Air Pollution and the London Fog
Oil-Fired Forge Furnaces

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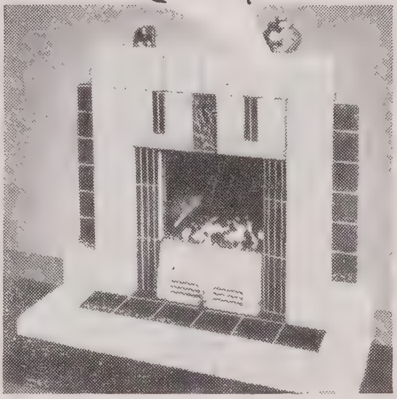

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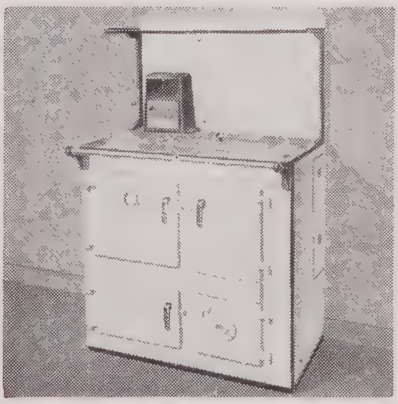

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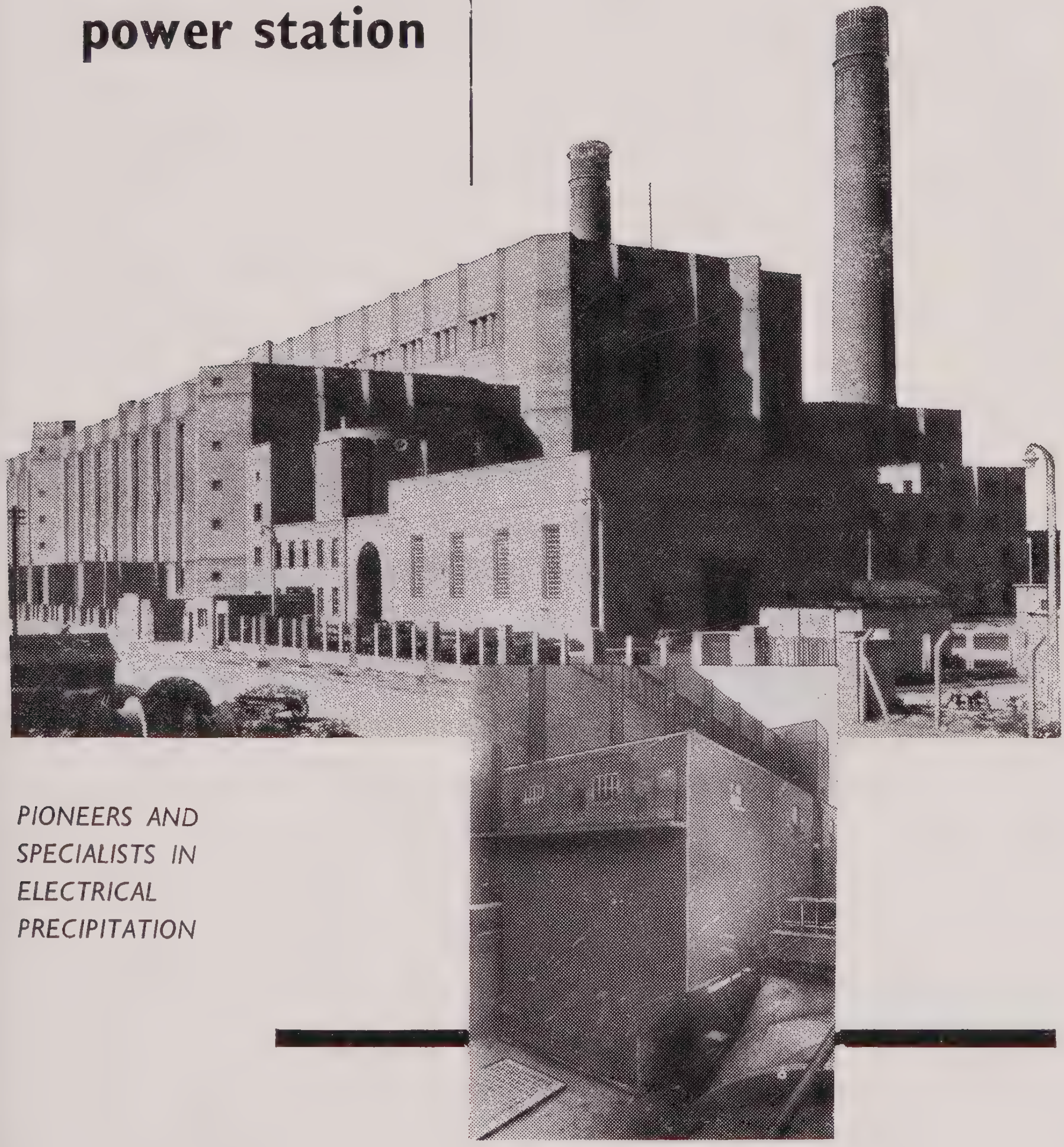

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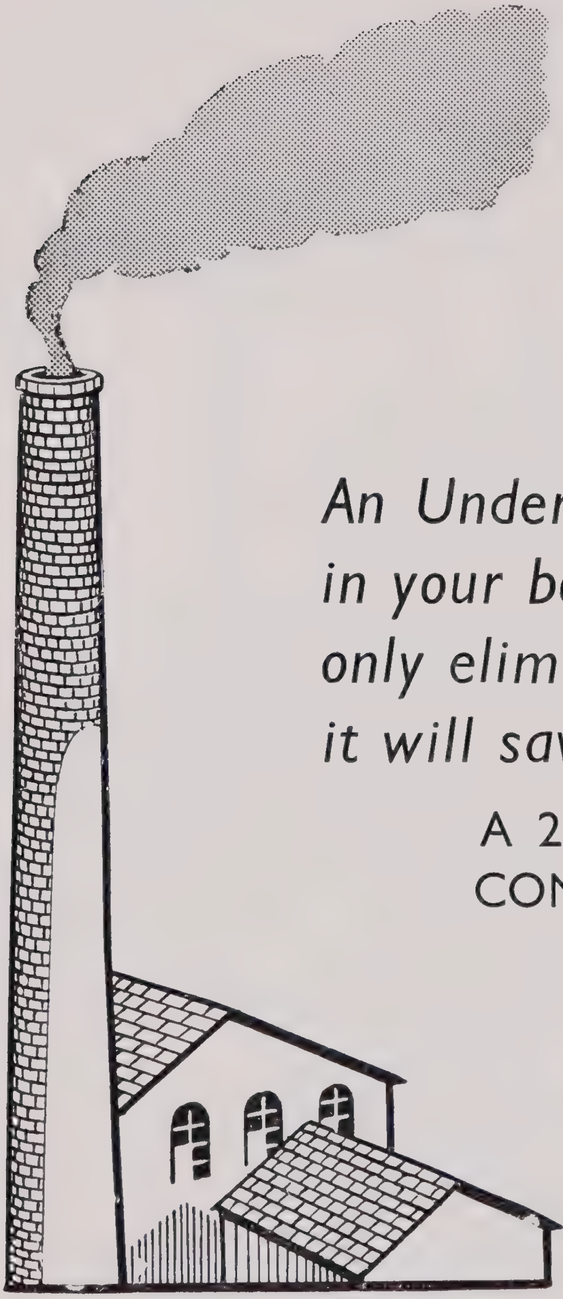

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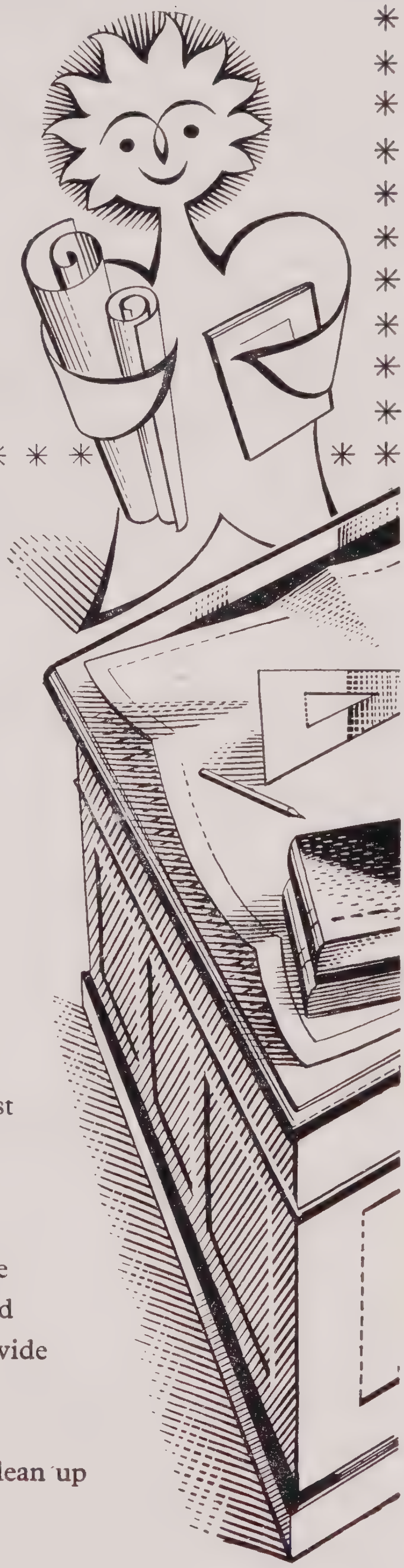

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SMOKELESS AIR

Vol. XXIV. No. 88 Winter, 1953

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SMOKELESS AIR

A Letter to a Member Overseas

DEAR Member: You ask for news and comment on what is happening about air pollution here, and want to know if it is true that the British public have at last wakened up on smoke—or what has quite suddenly come to be called smog. (This word, by the way, generally thought to be an American import, was in fact coined by our own Dr. Des Voeux as far back as 1905!)

There has certainly been an extraordinary upsurge of interest during the last two months (which incidentally makes straight editorial comment so difficult that we are publishing this letter instead)—but it remains to be seen whether it will be maintained and reach the point of impelling authority to begin in earnest the preventive programme that is necessary. You may rest assured that the Society will do its utmost to keep everything moving, although at the moment the ball is at the feet of the Government Committee of Inquiry, upon the final report of which so much will depend.

As you know, the London fog disaster last December was at the time given far less attention than is the case with other catastrophes, even of much less consequence. However, as one by one various reports have come out, so have the facts slowly penetrated the public mind, and as winter and another season of fog approached anxiety began to grow—noted of course by a Press always sensitive to public feeling.

Our own successful conference in Glasgow was given more publicity than ever before, and our office has been kept busy in supplying information, advice, references and photographs for the numerous articles and features that have appeared (or sometimes not!) in the papers and magazines. It is all most welcome to those of us who have been trying to kindle interest for years past in the problems of air pollution, but there is a danger that such publicity can overreach itself or become diverted into blind alleys—like, for instance, one named Smog Mask. Filter pads over the nose and mouth were in common use in the last century, and are well remembered by many older people, and as a first aid measure they no doubt have their value. And, after all, if we will keep to Victorian technics we must expect Victorian remedies. But if such matters are allowed to obscure and divert attention from the fact that the only safeguard against smog is to prevent it, then they may be doing more harm than good. The harm done to health by the ordinary day-to-day pollution and the frequent days of smoke-haze (the " Z " days) is in the long run more dangerous and costly than that caused by the sharp effects of the occasional major smog. No one, by the way, seems to have proposed smog masks for permanent city wear, nor have they been suggested for Westminster Abbey and other famous buildings!

Most awkwardly, the Interim Report of the Beaver Committee is likely to be published just after this issue goes to press. This is not likely to be more than a statement of the case, and it is to the Committee's final report that we must look for the definite, even bold, programme for prevention that we hope will be put forward and then accepted by the Government. The Society is preparing a memorandum of its own views for submission to the Committee, and to guide our Technical Committee in this task members throughout the country were invited to send in their own suggestions on what should be included. The response was heavy and excellent, and tribute should be paid to the well-informed, well-reasoned and practical nature of these suggestions—a heartening proof of the first-class membership the Society enjoys.

Generally speaking, too, there does seem to be far more understanding of the facts about air pollution, and the facts about what can be done, than there was only a few years ago. The Society, through the very persistence and soundness of its campaign, can claim some credit for this. You may be interested to know of two or three points about which people—the informed minority of people, that is—show most interest. First, there is the key problem of the supply of domestic smokeless fuel. One of the papers read at Glasgow was a valuable analysis of the problem, and showed how more and more smokeless fuel could be made available for the home—not all homes at first, but for the black areas that need it most, and where smokeless zones should be set up. Interest in smokeless zones themselves is growing fast, and it may be well that schemes will have to be put in some order of priority. No doubt you have seen that it is proposed that the whole of the City of London be made a smokeless zone.

Another discussion point is the strong probability that the corrosive sulphur oxide gases from our chimneys have a far more serious effect when they are associated with smoke particles, which act as carriers or precipitating agents. This " synergism " was discussed in our Summer, 1953, issue, and was referred to by Dr. Scott, of the L.C.C., at Glasgow. It means that although it is still most desirable (though difficult) to remove sulphur from flue gases of every type, its effects may be far less dangerous if it is free from smoke. So the old argument that it is little use bothering about smoke until we can get rid of the sulphur gases holds less water than ever it did.

Criticism of the unfortunate nutty slack and of the banking-up of open fires for all-night smouldering seems to be much stronger and more widespread than you might gather from the restrained pages of this journal. We did not have it anywhere on the agenda at Glasgow, but nevertheless it came out strongly in discussion, and one meets it frequently at little meetings where an audience has been listening to and discussing a smoke abatement talk for the first time. New points about all-night smouldering are: it may be that the smoke emitted, per pound of coal burned, is no greater than that from an ordinary coal fire. On the other hand as there is a greater likelihood of temperature inversion (fog producing conditions) during the night hours, smoke emitted then may be more dangerous than daytime smoke.

Hard on the heels of increased public interest come the inventors. Many bright ideas, all guaranteed to solve the smog problem, are thrust upon us. At the moment devices for cleaning smoke of its smoke content, or for dispersing it altogether, are to the fore. In this field the fog-sucking machine of an eight-year-old boy (sent to us by his proud father) vies with a scheme for artificial whirlwinds, another for pumping the fog down sewers, and another for spraying the fog with detergent, while one serious newspaper published a letter about some similar idea, and an advertisement in another paper appeals for business interest and backing. But these good people never seem to start by calculating the *volume*, or the *weight*, of the air they would have to deal with. Over the London basin, for instance, there would be several hundred *cubic* miles of fog, each cubic mile weighing about 5,000 tons. One gathers from that excellent film, *The City that Disappears* that such schemes are propounded to cure Los Angeles of its own peculiar smog, for in the film the point is made that to filter, or to move elsewhere, the air affected would require, in a single day, more power than the available generating stations could provide in a year!

The pleasant photograph that heads this letter is of Reykjavik, " the city of smokeless air " described in an article on another page. When you have read it you might care to compare this example of smokelessness in the very " place the depressions start from," with the plea in a recent advertisement of the Coal Utilisation Council that " Few things help more to make our climate tolerable than the cheerful comfort of a coal fire." One imagines that a citizen of Reykjavik might reply: " Few things help more to make *our* climate tolerable than the cheerful comfort of a clean city."

Another odd thing is that a few days after Mr. Norman Dodds, M.P., was told that the Government could not see its way to give a helping hand to the Society, by way of a grant, the Government spokesman in the House of Lords debate on air pollution generously said: " I think we should *pay tribute*, too, to the National Smoke Abatement Society for the work they have done in propaganda on this very important subject." (Our italics.) The speaker, curiously enough, was the Paymaster-General!

You ask how the Society is faring now that smoke is so often front-page news. The answer would be an unqualified " Fine," except of course for the fact that, like the Government, so many people pay us tribute only in a metaphorical sense. We seem more and more to be becoming a free public service, expected to know all the answers (if we don't we generally know who does), expected to assist everyone, but never expected to charge

(*Concluded on page* 66)

A Spate of Meetings

As news, and for the record, SMOKELESS AIR has always tried to report all meetings, debates and conferences on smoke and air pollution, but at the moment we are overwhelmed. Only if this journal were a monthly, or was several times its present size, *and* had its special editorial staff, could we deal adequately and fairly with all that should be reported. As it is we must severely condense and keep comment short.

Glasgow

First, a note about our own conference in Glasgow. Attendance was almost a record—exceeded only by our last Scottish conference at Edinburgh in 1947. The papers were excellent and informative. Sir John Charles's Des Voeux Memorial Lecture was of a high order—the *Manchester Guardian* described it as erudite and wary—and the interesting session on the London Fog Disaster followed it most appropriately. Smokeless zones, and on a more technical level, the prevention of smoke from the combustion of oil fuel, were other subjects; while the two long papers on solid smokeless fuels, contributed by a team of seven authors, not only provided an important session at the conference but have set forth some invaluable data that could not have come at a more opportune time. A leading fuel authority has since commented that this analysis of the problem of availability and distribution of solid smokeless fuel is something that should have been done, before now, at Government level.

The conference ended with a visit to the Loch Sloy hydro-electric station and dam, above Loch Lomond. Lowering clouds and Scotch mist undoubtedly added to the impressiveness of the setting. The Society, and all those attending, were appreciative of the generous hospitality and warm welcome by the Lord Provost and the City Corporation, and especially for the most enjoyable civic reception.

There is no need to record the papers themselves. As usual they are being published in full with discussions, as the *Proceedings of the Glasgow Conference*. Any member or representative of a member is entitled, on making a request, to receive a copy without charge. For others the price is 7s. 6d. per copy. (Copies will be sent as soon as they are available to all who were registered as attending the conference, but because of congestion of work at the office this may be rather later than usual).

Bristol

We would especially have liked to have more space to give to the one-day Symposium on Atmospheric Pollution organized by the Bristol and District Regional Smoke Abatement Committee, and held in Bristol on 22nd October. This was one of the best, if not the best, regional meetings we can recall, by reason of the quality and variety of the papers read, the discussions that followed them, the size and representative nature of the audience, and the Press and Radio publicity secured.

In the morning the effects of air pollution were discussed, Professor Parry, Bristol's M.O.H., speaking on health, J. Nelson Meredith, the City Architect, on buildings, and J. B. E. Patterson, of the National Agricultural Advisory Services, on Vegetation. Together, these excellent addresses made up a full and persuasive indictment. In the afternoon Mrs. D. M. Charlton, Chairman of the Women's Advisory Council on Solid Fuel, spoke on the prevention of domestic smoke, and Dr. A. Parker, Director of the Fuel Research Station, on practical methods of reducing industrial smoke. Dr. Bronowski, who was in the chair during the afternoon, opened a spirited discussion.

The North West Division in cheerful mood at lunch during a visit to the new Huncoat Generating Station, near Accrington. Standing is Dr. Burnett, Chairman. Next to him, left, is H. Moore, Divisional Hon. Secretary.

Not only were there many local authority representatives present, but also many from women's organizations, with senior schoolgirls, student nurses, and others. Congratulations to the Bristol and District Regional Committee, and especially to its Hon. Secretary, Mr. F. J. Redstone.

Liverpool

Air pollution came into the picture at the meeting of the British Association in Liverpool in September, and was well reported in the Press. Professor G. R. Clemo, of Newcastle, referred to it in his address as President of Section B, and gave a preliminary report of research he is conducting at his department in King's College, on the composition of smoke, about which we hope to report more fully in due course.

The Botany and Forestry sections combined to discuss the effects of air pollution on plant life, and papers were read by Dr. C. R. Metcalfe, of the Royal Botanic Gardens, Kew, Mr. T. R. Peace of the Forest Research Station, Farnham, and Dr. J. K. C. Bleasdale of the Botany Department, University of Manchester. Dr. Metcalfe discussed experimental work at Kew, and Dr. Peace referred in some detail to a recent investigation of damage caused to young trees by pollution from a neighbouring brickworks, which he described as " a fume investigator's dream." (A full report of this session was published in *Nature*, 10th October, 1953).

Baltimore

Although a full report has not yet been published we can briefly mention the 46th annual convention of the Air Pollution Control Association at Baltimore in May. Fifty papers were presented, and two separate sessions were held simultaneously. One series of papers was concerned with dust emission control problems, including one on equipment for measuring radioactive contaminants and one on a continuous recording visibility meter.

The other sections, or sessions, were on railroad smoke, the chemical industries, general technical questions, the iron and steel industry, other metal industries, municipal refuse disposal and incinerators, and finally on meteorology and stack gas diffusion.

London

The first conference of the recently formed British Occupational Hygiene Society was held in London on 2nd November at the London School of Hygiene and Tropical Medicine. It was opened by Sir Walter Monckton, Minister of Labour and National Service, who was followed by the President, Dr. Thomas Bedford, Director of the Environmental Hygiene

Research Unit of the Medical Research Council. Dr. Bedford gave an illuminating historical survey of the development of industrial hygiene legislation and study. During the afternoon session papers were read on " Measuring the Worker's Environment," " The Problems of Chemical Toxicity " and " Occupational Hygiene and the Industrial Designer." As the first two of these papers indicate occupational hygiene is to a considerable extent a specialized and localized field of atmospheric pollution, and especially in its investigations and methodology is a subject from which those concerned with the more general problem can derive knowledge and ideas. The conference was well attended and appeared in every way to augur well for the new Society.

Westminster

Many questions have been asked in recent weeks in the House of Commons on smoke, smog, smog-masks, the Beaver Committee, and also on whether the Government is going to take the advice of the Fuel Conservation Report of the Productivity Council and make a financial grant to the National Smoke Abatement Society. (The reply to the last was the customary negative.) In the House of Lords the Earl Jowitt referred at some length to air pollution in opening the debate on the Queen's Speech, and on 18th November a debate on the subject, in which a number of peers took part, was opened by Lord Amulree. The Earl of Selkirk, Paymaster-General, replied on behalf of the Government.

Yorkshire Divisional members at the Frickley Colliery, South Elmsall during a recent visit. Left to right are: C. T. Peacock (Hemsworth R.D.C.), A. C. Saword (Hull), Mr. Hill (Manager of the colliery), Mrs. I. Fern Smith (Women's Gas Federation), N. Hancock (York), H. E. Pearsall (Combustion Engineering Association).

Letter to a Member Overseas—*concluded*

a fee. Unlike other bodies Public Relations is not just a department of the Society—it *is* the Society.

In every respect but that of finance this is highly satisfactory and is just what the Society exists for, but as things are it is creating a strain that can only be eased by more funds or by deliberately damping down some of our activities. That's the logic of it, but in practice we just cannot damp down—above all at this present juncture, which, whether the country has awakened permanently or not, seems to be the chance we have always been itching for. . . .

A CHADWICK LECTURE ON AIR POLLUTION

By C. J. Regan, B.Sc., F.R.I.C.

Chemist-in-Chief, London County Council.

A well-attended Chadwick Lecture, at the Royal Society of Arts on 15th October, 1953, was given by Mr. Regan, with Dr. R. Lessing in the Chair. Mr. Regan first discussed historical aspects of the problem, and then dealt with the sources and nature of pollution, in the course of which he considered the constituents as follows:

(a) Let us first consider smoke. Smoke is the term generally applied to the visible products of incomplete combustion. Coal smoke contains a high proportion of carbon and also tarry hydrocarbons which add to its sticking power and its tendency to form sooty deposits. One important property of smoke is that, because of the small size of many of the solid particles contained in it, it behaves in many ways like a gas and has similar penetrative powers. Thus smoke can enter a house in the air which passes through cracks or through a ventilating brick; but, whereas the air molecules bounce off the wall surface, the smoke particles, owing to their sticky nature, may adhere and render the surface dirty. The effect of smoke on outside walls of buildings is, of course, too well known to need further comment here. It is difficult to assess the actual weight of smoke produced over the whole country, but it has been estimated that the yearly total is 2.4 million tons. At least one-half of this comes from bituminous coal burnt in open domestic grates, the remainder being from industrial sources, railways, etc.

It is of interest to note that on the basis of the reduction in the use of domestic coal and also the extension of electrification of railways, there should have been a definite decrease in smoke production in recent times; but the observations, so far as I am aware, have not generally shown any marked effect.

(b) There is actually no clear-cut division between smoke, and ash and grit, since some of the ash particles which escape from chimneys are so finely divided that they also remain suspended in the air. But analysis of the total suspended matter in town air has shown the solids to be 85 per cent. derived from smoke and only 15 per cent. from ash; so for practical purposes the suspended solids in air, as filtered out by the measurement process described later can be roughly taken as being the smoke content of it. Ash is the non-combustible matter which remains after the carbonaceous matter in coal has been burnt. It can vary within very wide limits and most is retained in the ash pit; but a certain proportion, depending on the type of furnace or appliance in use and on the type of fuel, escapes with the gaseous products of combustion up the chimney. It may also be accompanied on that journey by some of the unburnt fuel, particularly if this is of a finely divided nature. Industrial flue gases have velocities up to 40 ft. per second which is fast enough to carry particles up to 1/10th inch diameter. From such an installation, if there is no efficient grit arrester, the neighbouring premises may be subjected to rain a of particles of ash and grit of all sizes up to 1/10th inch, falling to earth in a few seconds. In the case of domestic grates, the flue gases do not generally travel up at more than 5 ft. per second, so that the particles which are carried up the chimney are not more than 3/1,000th inch diameter. Hence, the emission of ash and grit from domestic fires is usually small; but, in total it is probably of the order of 0.2 million tons per year for the whole country. The larger diameter industrial grit has a greater nuisance value and is usually concentrated in a small area round the particular source.

(c) In some respects it is probable that the sulphur oxides emitted into the air are the most important aspect of the pollution problem. The amount of sulphur in coal varies, but 1.5 per cent. is a fair average figure. As has already been mentioned, nearly all this goes up the chimney in the flue gases largely in the form of sulphur dioxide. The chemical formula being SO_2, it follows that the weight of SO_2 is just double that of the original elemental sulphur. Hence the 205 million tons of coal burnt each year emit into the atmosphere 6.2 million tons of sulphur dioxide. This is equivalent to 9.5 million tons of sulphuric acid (H_2SO_4), the eventual product. It has been estimated that the average time sulphur dioxide remains in the air is 12 hours. About one-fifth is brought down by falling rain and a similar amount is blown out to sea. Much of the remainder is retained on buildings or vegetation.

Another source of air pollution, which is of growing importance in view of the great increase in the past 30 years or so of the use of mechanical transport, is that produced by the incomplete combustion of petrol or diesel oil. In 1932 I dealt with this subject in a paper in " Chemistry and Industry " entitled " Motor Fumes and Atmospheric Pollution." My attention was drawn to the problem by the necessity for considering measures for increasing the ventilation of the vehicular tunnels under the River Thames. The main hazard was obviously the carbon monoxide (due to incomplete combustion of petrol) which may be present in exhaust gas to the extent of about 5 per cent. It also became evident that other factors came into consideration and some of these will be mentioned later.

Other contaminating matters which can only be listed are hydrochloric acid, hydrogen fluoride and silicon tetrafluoride, which are produced in small amounts in the combustion of coal. Mention should also be made of gases from chemical works which are carefully supervised through the activities of the Chief Alkali Inspector, Ministry of Housing and Local Government; for example, hydrochloric acid, nitrogen oxides, carbon bisulphide, hydrogen sulphide, particles from blast furnaces and cement kilns, etc. It is worth while noting that the last-mentioned can cause widespread nuisance as was evidenced in March of this year when the meteorological conditions were unusual in that for practically the whole of the month there was only a very slight air movement in an east to west direction, and a large area of North-West Kent and South-East London was covered with a film of calcium-containing dust derived from the chimneys of the large cement industry in the Dartford area. Such cases, however, are special problems caused by chemical industries and affect only limited areas, so I will not enlarge upon them further, except to mention one classical example of how they can be scientifically investigated. This is related in Medical Research Council Memorandum No. 22, on Industrial Fluorosis, which describes the study made of the hazard to men and animals near Fort William, Scotland, caused by the emission of fluorine compounds into the air from an aluminium factory.

In passing, it may be remarked that we, in this country, should be thankful that we are not subjected to natural atmospheric pollution such as has been experienced in some other parts of the world. For example, Butlin records that in Swakopmund (S.W. Africa), mud erupts every few years producing an atmosphere described as, in appearance, like a London fog, but also containing large quantities of hydrogen sulphide with its evil smell and usual effects. The phenomenon is caused by the activities of sulphate-reducing bacteria in a sea bed of gypsum.

The Effects of Pollution

After briefly reviewing the measurement of pollution Mr. Regan continued as follows:

The detrimental effects of air pollution are now generally well known. They may be summarized under the following headings:

(*a*) Corrosion and damage to buildings, fabrics, etc.
(*b*) Damage to health.
(*c*) Damage to agriculture.
(*d*) Dirt and nuisance.
(*e*) Waste of fuel.

The assessment of the cost of these effects is one of great difficulty, and, indeed, cannot well be attempted in regard to category (*b*) (health), for it is impossible to make a monetary estimate of the impairment of health caused by air pollution. It is worth putting on record, however, that a government report in 1945 quoted £45 million per annum for damage to buildings, equipment, fabrics and agriculture, together with the direct waste of fuel involved. Parker, in 1950, estimated such cost to be at least £50 million which is equivalent to about five shillings for each ton of coal burnt. This is an important figure which should be well known, but is probably insufficiently realized. These estimates are on the basis of average atmospheric pollution and do not take into account the additional factors which arise in the case of a dense fog with consequent delays and dislocation of traffic and industry; it has even been suggested that an overall estimated cost (not including health) for London might be one million pounds per day for the fog in December, 1952.

(a) A vast amount of investigational work has been done by many workers on the corrosion of metals and many papers have been published through the years dealing with both the theoretical and practical aspects of the subject. In particular, reference should be made here to the recent work under the auspices of the British Iron and Steel Research Association in which small reference specimens of ferrous and non-ferrous metals were exposed to atmospheric corrosion at many places both in this country and abroad.*

Corrosion

Among the effects discussed by Mr. Regan was that of corrosion. He said:

Before leaving this aspect of the subject, mention should be made of a consideration which will subsequently be developed more fully; that is, the interaction of two different types of pollution. In this particular instance I refer to the increase in the effect of sulphur corrosion in the presence of particulate matter. The classical investigation into this was done by Vernon and he showed the increased corrosion rate caused by sulphur dioxide in air in the presence of particles of ammonium sulphate and of charcoal respectively. Vernon was of the opinion that the effect of the charcoal was primarily physical, locally increasing the concentration of sulphur dioxide by adsorption. I would suggest, however, that in atmospheric pollution, in which the solid particles will give a similar effect to that of charcoal in Vernon's laboratory investigations, there may be another effect, in that the adsorption of sulphur dioxide on the particles in contact with the oxygen of the air may cause catalytic surface oxidation to sulphur trioxide, thus producing, in the presence of the water in the air, sulphuric acid with its much greater corrosive action. Coste and Courtier showed that under normal conditions the sulphur in air appears to be present almost entirely as the dioxide, and this catalytic change to the trioxide, if proved, is hence of first importance.

Not only metals are corroded by acid atmospheres; so also are building stones to a greater or lesser degree according to their chemical composition. A report by R. J. Schaffer published by the Building Research Station, D.S.I.R., in 1932, gave much information on this subject, which has subsequently been supplemented by recent papers (1951) to the Building

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*See this journal, Winter, 1952, No. 84, page 75.—Ed.

Research Congress. The softer stones, which are more easily worked, are often limestones or dolomites. These are, from their chemical composition, easily attacked by the acid brought down by rain. The calcium sulphate formed from the former type is only slightly soluble in water, but from the latter both calcium and magnesium sulphates are produced and the latter is readily soluble; the dolomitic type is hence more vulnerable. Again, the carbonaceous matter adhering to the surface of the stone may accelerate the action by increasing the quantity of sulphur oxide adsorbed. Acid atmosphere attacks on the better granites, sandstones, well-baked bricks and tiles are less severe.

Much has been written about the effect of atmospheric pollution on the structures of some of the best known ancient buildings in this country; for example, T. H. Turner has given some details in the cases of York Minster and Salisbury Cathedral. But no more time can be devoted to this corrosion aspect of the question, except merely to mention the damage done to fabrics such as curtains which, as the housewife well knows, sooner or later rot away. This is undoubtedly due to the effect of sulphur oxides or sulphuric acid.

The deleterious effect of atmospheric pollution on health has recently had great publicity from the disastrous effects which resulted in London from the fog of 5th-8th December, 1952. The onset of this was determined by the meteorological factors of almost complete absence of wind or air movement and low temperature, which produced what is technically described as an " inversion," whereby the normal upward air circulation by convection currents was arrested. Hence, at ground level and for a long distance above it there was no air movement, and smoke, sulphur oxides, exhaust fumes and other contaminants increased to concentrations many times those normally prevalent. At County Hall the average SO_2 content of the air for the 48-hour period ending Monday a.m., 8th December, was 1.34 parts per million and the average smoke (as milligrams black suspended matter per cubic metre) was 4.46. These were unprecedented figures being, respectively, about 10 and 16 times the average; but the full effects of the phenomenon were not apparent until later when the death statistics became available. It was then evident, as recorded by Logan that this four-day fog in Greater London had been responsible for some 4,000 deaths in the following two weeks. These were associated with respiratory troubles and occurred in all age groups, but particularly in those aged 45 and over. Deaths assigned to bronchitis and pneumonia increased eight times and three times, respectively, in one week.

This occurrence was on a much larger scale than that of any previous event of its kind, but similar conditions had arisen in the Meuse Valley, Belgium, in December, 1930, and at Donora, U.S.A., in October, 1948. The death rolls were, however, only about 60 and 20 respectively. Nevertheless, the latter incident caused great concern in America and was the subject of a very thorough and complete investigation afterwards by the United States Public Health Service. Unfortunately, the atmospheric conditions had completely altered by the time this could be planned, so that the most important direct evidence had disappeared. It is fortunate that in the case of the London fog there are available the records of a number of observation stations in the area so that certain basic data are known. It is impossible in the time available to go into detail on this matter, but it should be added that the conditions which arose in London last year negatived the view which had been expressed by some, that events like those at the Meuse Valley and Donora could only occur in districts, such as they are, enclosed in deep valleys. It must be remembered, as can readily be seen by examining a contour map, that London itself is in a basin (or perhaps a deep-sided saucer is a better description) surrounded by ranges of hills circling round on the north and south sides and running down to the Thames Valley. It must be borne in mind, too, that having happened once, there is no reason why a similar set of conditions should not occur again unless steps are taken to decrease the quantity of polluting matter emitted into the air.

The consequences of the London fog were, of course, the " acute " effects of air pollution; that is, comparatively short period exposure to relatively high concentration; but what are the possible " chronic " effects due to long exposure to less concentrated pollution? This is a matter on which it is not possible to give such direct evidence, but it is one of great importance. Undoubtedly the deprivation of sunlight tends to produce rickets in growing children, as would be expected, in view of the need for ultra-violet light to convert the provitamin D circulating in the blood stream to the vitamin itself by irradiation of the skin. Particles of smoke, particularly particles containing sulphur acids, are irritating to the lungs, and it is now generally agreed that a smoke and sulphur polluted air has a serious effect on general health, especially in the case of people prone to respiratory diseases.

Lung Cancer

Until recently fatal respiratory diseases were thought of in terms of pneumonia, bronchitis and tuberculosis of the lungs; but recently the question of cancer of the lung has come into the picture. Stocks has stated that, whereas, in 1935, 3,400 deaths were attributed to this cause, in 1950 the figure was 12,000. It seems that, in part, this increase may be due to improved diagnosis, but even if that is so, there is undoubtedly an increase to be accounted for. Much research has proceeded as to the substances which can produce cancer, and certain chemicals have been proved to be " carcinogens." At least three of these have been identified as being present in atmospheric dust, benzpyrene, arsenic and radioactive particles. The first-mentioned is present in smoke from a bituminous coal, and it may well be, from studies which have been made on a statistical basis, including consideration of the degree of atmospheric pollution and wind drifts, that air pollution of this nature is a predisposing cause of the disease. Another possibility has been suggested by a botanist, Bleasdale, who points out that sulphydryl compounds stimulate plant growth by increase in cell number, whereas partially oxidized sulphur radicles inhibit cell division, the actual rate of cell division being to some extent controlled by the relative concentrations of these radicles and sulphydryl compounds. Such a system is common to both plants and animals. He points out that coal smoke contains sulphur dioxide and that, in air polluted in this way, plant growth is less than in pure air. If, however, plants are subjected to polluted air for only part of the 24-hour day their growth rate is higher than for plants in pure air. In his view the concentration of partially oxidized sulphur radicles is increased in the impure air, but on removal to pure air it is reduced again by oxidation and reduction, and the sulphydryl compounds that accumulated during the period in polluted air are freed to stimulate growth. It is suggested by Bleasdale that this effect in plants may have some relation to the abnormal growth of bronchial epithelium which occurs in lung cancer. No doubt the suggestion will be investigated in the appropriate research quarters, and at present it can only be regarded as a possibility. Similarly must be classified the fact pointed out by Hockenhull that derivatives of sulphuric acid have been shown to inhibit certain respiratory enzyme systems. Again, sulphur oxides would come into question, but more work is required before any definite conclusion can be reached.

An investigation just published in the *Lancet* of 10th October, 1953, by

Amdur, Melvin and Drinker tends further to inculpate sulphur oxides, for it shows the decrease in tidal volume (that is the amount of air inhaled per respiration), and the increased rate of respiration and pulse-rate in air containing small amounts of sulphur dioxide even down to 1 part per million, which is less than that present in the London fog. Moreover, reference is made to the worse effect of sulphuric acid mist which, as already stated, can be produced by catalytic oxidation in the presence of smoke particles.

Petrol and Diesel Fumes

Something should be said about fumes from petrol and diesel fuels. Carbon monoxide is present in the exhaust from a petrol driven vehicle to the extent of about 5 per cent., and in the congested streets of London it may be present in quiet weather to the extent of about 30 parts per million. This is much below the toxic limit for long exposure, which has variously been stated at 100-200 parts per million; but it is probable that this limit was reached at times in the London fog; for although, for part of the period, traffic was completely at a standstill, at other times it was crawling in and out of low gear when the proportion of carbon monoxide in the exhaust gas is greater than the normal 5 per cent. There are other constituents of motor exhausts which may be worth further study. Keeser and others examined the toxic action on mice and guinea pigs of exhaust condensates and found that these caused lung injury; it must be remembered that, although they normally occur only in extremely minute amounts, they will be at a maximum in fog.

Bearing these considerations in mind, it may be useful to attempt to summarize the possible causes of the London fatalities. It is evident that they were not due to one sole toxic constituent, but to the interaction of several. It is probable too that it was not just a summation of the effects, but something more akin to a geometrical progression. We may start with carbon dioxide which, no doubt, increased in concentration near the ground; this tended to increase the depth of breathing which caused the inhalation into the lower part of the lungs of considerable amounts of black suspended matter impregnated with sulphur dioxide which was oxidised to trioxide and thus to sulphuric acid. This may have affected the respiratory enzyme system or had some other specific toxic action. Other possible factors from the combustion of coal which may have been involved were hydrogen fluoride and silicon tetrafluoride. At the same time, carbon monoxide was inhaled which, with its affinity for haemoglobin 300 times as great as that of oxygen, decreased the proportion of oxyhaemoglobin present in the blood quite appreciably, with a debilitating effect; other motor exhaust gas products may have played some part, as may also nitrous fumes which are present in the exhaust from diesel engines.

Time will only permit a very brief reference to the effects on agriculture. A sooty deposit on leaves blocks up the stomata and reduces the absorption of carbon dioxide. Oxides of sulphur have a direct toxic action on the plant and increase the acidity of the soil. Reduction of sunlight and ultra-violet radiation have a general devitalizing effect. The effect of air pollution on plants is more severe during winter than summer, and hence species which are not dormant during the winter (e.g. Spring cabbage, rye grass) suffer most.

The dirt and nuisance caused by smoke and grit are too well known to need more than a passing mention. Those who were in London last December will remember the extraordinary amount of deposit adhering to windows and paintwork. These effects are costly having regard to the cleaning which is necessary. Clothes and fabrics such as curtains, too, have to be laundered.

Smoke is really unburnt fuel, so that

the 2.4 million tons of smoke previously mentioned as being emitted in this country mean the waste of that quantity of fuel.

Abatement

Since a Government Committee is now sitting to consider this question, I shall summarize only very briefly my personal views on some of the aspects of this matter. The considerations can be classified:

(*a*) Coal and allied fuels—
  (i) smoke
  (ii) ash and grit
  (iii) sulphur
(*b*) Oil fuels—
  (i) road vehicles
  (ii) other oil firing; sulphur and smoke.
(*c*) Other sources.

(*a*) Whilst realizing the existing difficulties in coal production and distribution it must be pointed out that an increase in the extent to which the commodity is cleaned before delivery to the consumer would be beneficial in several ways:

(i) The replacement of domestic bituminous coal by smokeless fuel would do much to reduce smoke, and a further reduction could be made in industrial plants by ensuring the supply of the most suitable type for any given installation, and by careful training of the operative staff. Moreover, the general adoption of the smoke eliminator door devised at the Fuel Research Station, which provides the extra air required for the necessary period after stoking, would help to abolish the production of smoke by small plants.

(ii) The emission of ash and grit is largely due to industrial plants and can be prevented by careful management and the provision of suitable grit arrestors.

(iii) Sulphur is the main difficulty, for it will go up the chimney wherever coal (or oil fuel) is burnt, unless a system of flue gas washing is installed. This can only be contemplated in the largest plants, and is only operating at two electricity generating stations in this country. It is costly, for the Battersea process is stated by Rees to be equivalent to seven shillings per ton of coal burnt; but experiments at the Fuel Research Station on the Fulham-Simon Carves non-effluent ammonia liquor process are promising and indicate that, so far as the liquor is available, a very much cheaper process can be devised which has the added advantage that it recovers sulphur, of which there is a shortage, both as sulphate of ammonia and elementary sulphur. In considering the advisability of adopting such a system in large coal consuming plants in congested residential areas, the cost, previously stated, of air pollution effects must be borne in mind. This amounts to at least five shillings per ton of coal burnt, not including the health aspect; the latter must be much greater, though it cannot well be assessed. Hence, some reasonable expenditure on sulphur removal is economically justified, and the Fuel Research Station experiments could well be extended to a large scale pilot plant installation. It must, however, be pointed out that the view has been expressed in some quarters, that if the gases are emitted from tall chimneys they are sufficiently dispersed in the upper atmosphere to render them relatively innocuous. Obviously more study of this dispersion is desirable, though the occurrence of deep inversions when the fumes will come down more or less directly to earth cannot be ignored. Moreover, there must

(*Concluded on page* 76)

U. S. Association's Membership Growth

The A.P.C.A's Successes

By Charles W. Gruber

We are pleased to be able to publish this account, specially written for this journal, of how the Air Pollution Control Association solved its membership and financial problems, especially as an urgent drive for more support for the National Smoke Abatement Society is at present being started. Possibly the American scheme is not quite what we need for our own case, but it gives us some stimulating ideas and in any case it is heartening to read how another hard-up association concerned with air pollution worked its way out of its difficulties. Mr. Gruber is Chief Smoke Inspector, City of Cincinnati, and is a Past President and Chairman of the Membership Committee of the A.P.C.A.

The Author

IN order to fully appreciate what has taken place in the Air Pollution Control Association in the last several years, one must realize that the Air Pollution Control Association and its predecessor, the Smoke Prevention Association of America, had its beginning more than 45 years ago. From 1907 to 1950, the affairs of the Association were guided by a small group of smoke abatement officials, mostly from the mid-western part of the country, with a small number of industrial representatives with whom the officials came in contact as associate members.

In the 43 years of existence prior to 1950, membership had grown from the handful who started the Association to about 300 individuals who paid $10.00 a year dues, to afford an annual income of $3,000.00.

By 1950, the demands of the public for cleaner air had become such that the modest organization of the Smoke Prevention Association of America was not adequate enough to serve either the needs of the public or industry in the effort to find the solutions to the problems of providing the public with cleaner air.

What should be done? Obviously, the entire structure of the Smoke Prevention Association of America needed overhauling. After much co-operative study by smoke abatement officials and industry representatives, changes in the by-laws, including a change in the name to incorporate the words " Air Pollution " were adopted at the annual meeting of the Association held in Montreal, Canada, in June, 1950. The old name, Smoke Prevention Association, gave way to the newer designation, Air Pollution and Smoke Prevention Association of America, which was, later on, shortened to our present name, the Air Pollution Control Association. Thus, the year 1950 should be regarded as the beginning of a new era of the Association.

The governing principle of the new organization is one of balance of control between air pollution control officials and the representatives of industry with the officials having the deciding vote in case it should be needed. The Board of Directors is made up of eight air pollution control officials and eight representatives of industry in addition to the president who, according to the By-Laws, must be an air pollution control official. The main purpose of the revitalized Association, as stated in the By-Laws, is to co-operatively seek the solutions to the air pollution abatement problems, *industry by industry*. This will be accomplished through the technical committees from each important industry, all functioning under a Technical Co-ordinating Committee.

Those responsible for the reorganization realized that the fine objectives of the Association were as so many words without a headquarters staff to guide the comprehensive programme called for in the new By-laws. How was such a programme to be financed?

In order to obtain sufficient financial support primarily from industry, three classes of membership were established; sustaining memberships at $250.00 per year, company memberships at $50.00 per year and individual memberships at $10.00 per year. In order to maintain the balance between the officials and industry, each membership, whether sustaining, company or individual, was given only one vote. Therefore, the difference in membership is found only in the extent to which an organization wishes to support the work of the Association.

The enthusiasm for the reconstituted organization was at a high pitch following the Montreal Convention. A Membership Chairman was appointed and he readily found a number of energetic industrial leaders who went to work with the zeal of a patriot to promote A.P.C.A. memberships within their own particular industry. He, himself, did a fine job in the coal industry. There was no sales literature, nor strongly organized promotional campaign, but within a very short time, sustaining and company memberships started coming in. The success of that first enthusiastic drive was, no doubt, due in the first place to the rightness of purpose of the Association and secondly, to the personal letters and contacts by the industry men to the firms who should support A.P.C.A. The response to this first membership appeal was such that within six months after the Montreal meeting, the Association could proceed to employ an executive secretary. This was done along with establishing a national Headquarters. Such tangible evidence of progress further aided in obtaining new members.

By the time of the 1951 Annual Meeting, the membership was as follows:

Sustaining Members	69 at	$250.00	$17,250.00
Company Members	33 at	50.00	1,650.00
Individual Members	389 at	10.00	3,890.00
	491		$22,790.00

The annual meetings of the Association have always been successful from both attendance and the quality of technical papers presented. The high calibre of the technical programmes at annual meetings have done much to promote membership. However, during the next year, the first blush of enthusiasm for the new organization began to fade and while some progress was made, it did not in any way match the gain in membership for the first year's operation.

While plans were being made for a vigorous drive, the Chairman of the Membership Committee became seriously ill and had to abandon the task in the interest of health. The author was asked to take over this work early in 1953. From the success of the first effort, it became obvious that the basic plan was still a good one and the new Membership Committee was so organized.

The present membership plan is fundamentally as follows:

1. Establish industry groups, patterned after the breakdown of the

Technical Co-ordinating Committee.

2. Appoint in each industry group a membership sponsor who is actively interested in the success of A.P.C.A. and who carries sufficient weight among his associates to bring in sustaining and company memberships by, more or less, personal solicitation. The membership sponsor can act individually or he may select one or more assistants within his group as he so desires.
3. Call upon each air pollution control official to carefully and thoroughly go over the catalogue of industrial firms in his area or those of which he knows and furnish this information to the Membership Committee Chairman.
4. Upon receipt of this information, the Membership Committee Chairman will forward such names to the Industry Membership Sponsor for active solicitation.

The key to success of the growth of membership is the Industry Membership Sponsor. With the right man at the helm of each industry, membership will grow as it has in the past several years. Today the Association has a total of 794 memberships of which 81 are sustaining memberships 108 are company memberships and 605 are individual memberships. The growth of the Association, year by year since 1950, is shown in the following table:

Year	*Individual*	*Company*	*Sustaining*	*Total*	*Membership Income*
1950	340	—	—	340	$ 3,400.00
1951	473	24	27	524	12,680.00
1952	467	62	76	605	26,770.00
1953	605	108	81	794	31,700.00

Incomewise, the Association has grown nearly ten-fold in the past three years.

This is a remarkable record, but then A.P.C.A. is a remarkable association of interests joined together in a single orgnization to do a collective job. In A.P.C.A., air pollution control officials, the public and industry are all pulling together in the same direction and thus the sum of the forces lead steadily toward the goal of cleaner air for our industrial communities. Certainly there is a tug here and there that shunts a bit of effort in an opposing direction, but the path along which the association travels is well charted and we firmly believe that industry and the public will continue to support our programme with ever increasing membership affiliations.

Air Pollution, by C. J. Regan
—concluded

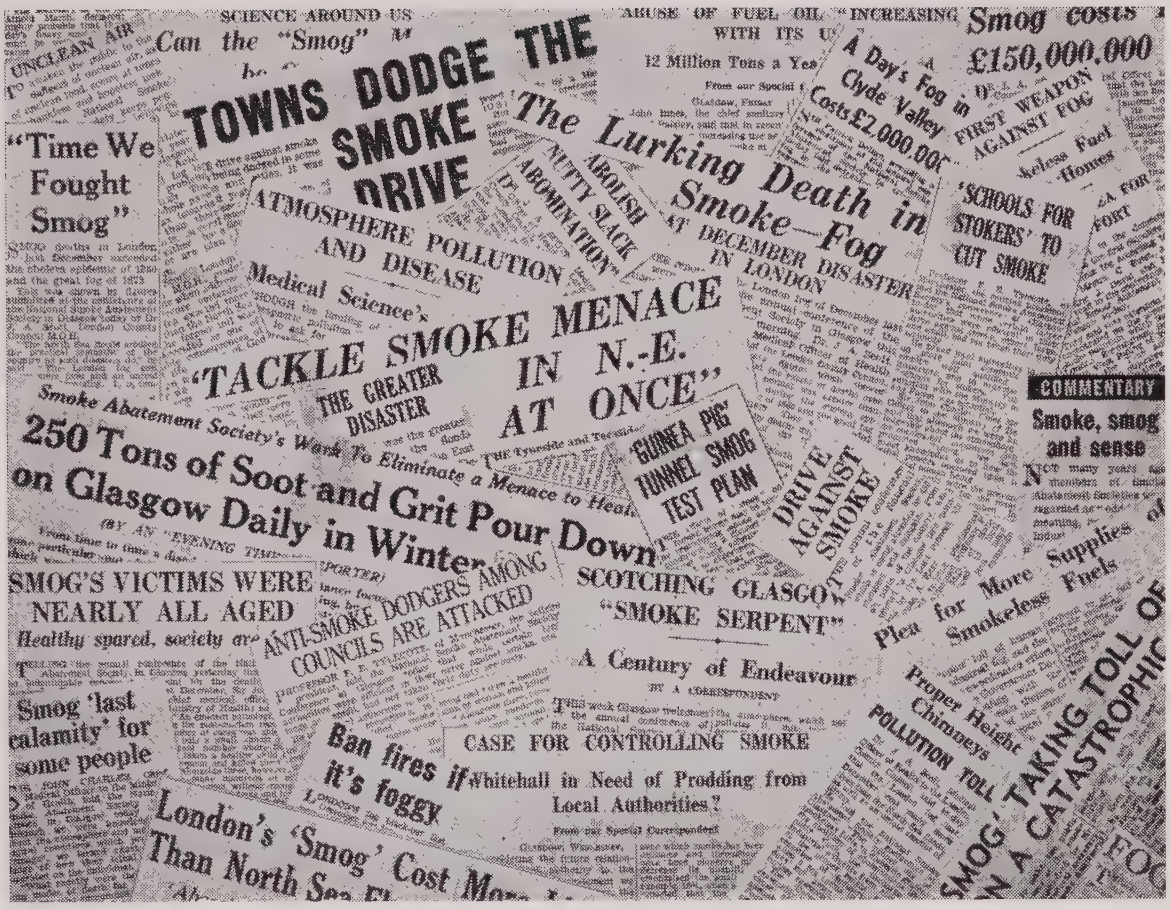
be borne in mind the possibility of local high concentration of sulphur oxides due to the presence of one or more large coal consuming installations (e.g. electricity generating stations) in an area.

(*b*) (i) Devices have been suggested and patented for the removal of carbon monoxide from motor vehicle exhaust gases, but they have not been generally adopted and do not seem to be very practicable.

(ii) Fuel oil may contain several times the percentage of sulphur in coal, and in large installations the same considerations apply as mentioned in that connection. Provided that control is efficient there should be little trouble from smoke.

(*c*) Other local sources of pollution such as fluorine or cement dust can be adequately dealt with by appropriate means, but will not be considered in detail as they affect only limited areas in particular localities.

Nor will I venture to speculate as to what additional legislation, if any, is desirable. This is a matter for recommendation by the Government Committee; such questions as " smokeless zones " may be included in this category.


SCIENCE AROUND US
Can the "Smog" ...
UNCLEAN AIR
"Time We Fought Smog"
TOWNS DODGE THE SMOKE DRIVE
ABUSE OF FUEL OIL WITH ITS ...
12 Million Tons a Year
"INCREASING ...
Smog costs £150,000,000
A Day's Fog in Clyde Valley Costs £2,000,000
FIRST WEAPON AGAINST FOG
The Lurking Death in Smoke-Fog
AT DECEMBER DISASTER IN LONDON
ABOLISH NUTTY SLACK ABOMINATION
ATMOSPHERE POLLUTION AND DISEASE
Medical Science's ...
'SCHOOLS FOR STOKERS' TO CUT SMOKE
"TACKLE SMOKE MENACE IN N.-E. AT ONCE"
THE GREATER DISASTER
COMMENTARY
Smoke, smog and sense
Smoke Abatement Society's Work To Eliminate a Menace to Health
250 Tons of Soot and Grit Pour Down on Glasgow Daily in Winter
'GUINEA PIG' TUNNEL SMOG TEST PLAN
DRIVE AGAINST SMOKE
SMOG'S VICTIMS WERE NEARLY ALL AGED
Healthy spared, society are ...
ANTI-SMOKE DODGERS AMONG COUNCILS ARE ATTACKED
SCOTCHING GLASGOW'S "SMOKE SERPENT"
Plea for More Supplies of Smokeless Fuels
A Century of Endeavour
Smog 'last calamity' for some people
CASE FOR CONTROLLING SMOKE
Whitehall in Need of Prodding from Local Authorities?
Ban fires if it's foggy
Proper Height Chimneys
POLLUTION TOLL
'SMOG' TAKING TOLL OF ... IN A CATASTROPHIC ...
London's 'Smog' Cost More Than North Sea ...

What they said about the Society and its Conference

Winning Battle

Not so long ago the National Smoke Abatement Society was a voice crying in the wilderness. . . . But things have changed. London had a fog last winter. Questions were asked in the Commons, the broadcasters and television services discovered that smoke was news, *The Times* correspondents raised their pens in dignified protest and the *Manchester Guardian* discovered to its alarm that it was in danger of being on the side of the majority. (Incidentally, who would have believed a few years ago that the *British Medical Journal* and the *Lancet* would between them devote 6½ columns of their leading editorials to smoke abatement, as they did in their issues of 10th October, 1953?). So, dizzy with the publicity that these last nine months have surrounded their efforts, if not overcome by the financial grants showered on the Society by a beneficent Government and with three members of its Council appointed to the Beaver Committee of inquiry into air pollution, some 450 members and delegates met from 30th September to 2nd October for their 20th annual conference in the heady atmosphere of success. . .—*The Medical Officer, 17th October*, 1953.

Poor Fish!

We are in the plight of fish whose stream is poisoned by the effluent of a factory: our native element is being made noxious to us, and already some of us have lost our lives. Were we indeed fish, stringent regulations would at once come into force to prevent the nuisance. It is an odd reflection that air pollution (with which past lawgivers made several tinkering attempts to deal) has probably grown steadily heavier through the centuries, so that in this respect we have sunk, generation by generation, into slum conditions. Our dirty cities would have shocked our forebears as much as their drains shock us. It is surely time to help the National Smoke Abatement Society to clean the place up. . . .

The wholesome dread most Londoners have of a recurrence of last year's episode may well be our most powerful friend. One way of hastening useful action would be for more of us to join the National Smoke Abatement Society.—*The Lancet*, 10th October, 1953.

Hearken More Closely

Today, as fifty years ago, we are using our fuel resources wastefully, recklessly, and, moreover, dangerously. It is more than time that we made an effort to restore the position. With that end in view we might hearken a little more closely to the recommendations of the Smoke Abatement Society which they have put so freely and generously at our disposal. Smoke costs a lot.—*The Medical Press*, 11th November, 1953.

Appreciation—

Glasgow should be glad that the National Smoke Abatement Society are holding their annual conference in the city.—*Glasgow Herald*, 1st October, 1953.

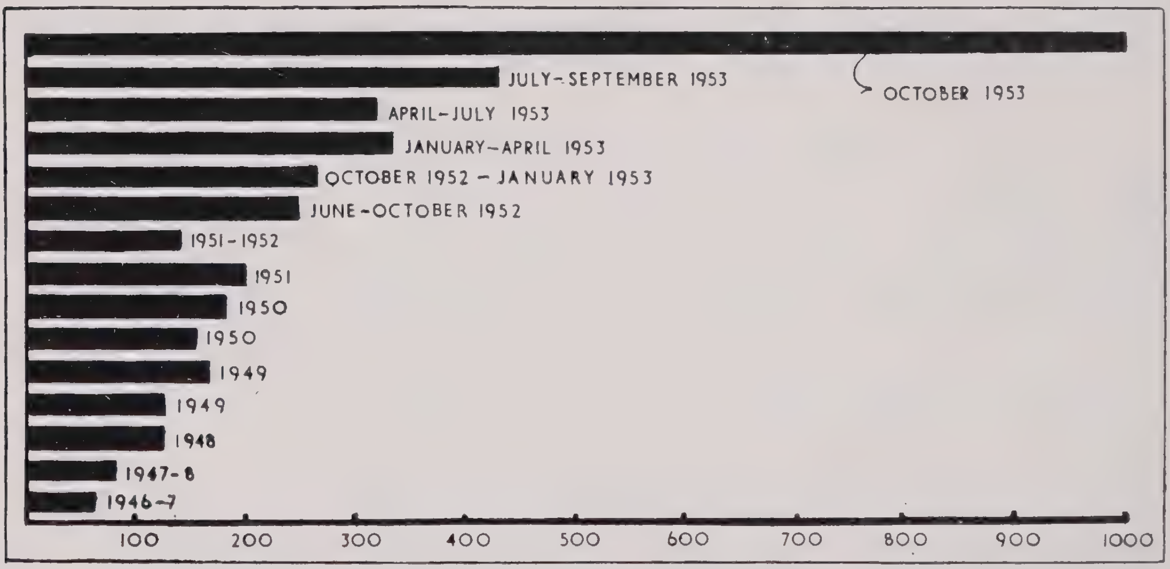
—and More

For years the National Smoke Abatement Society have been waging a noble battle for clean air in our towns and cities. Their chief opponents have been indifference and a dull acceptance of the *status quo*. . . .—*Western Mail*, Cardiff, 2nd October, 1953.

The Prize Headline

SOMETHING NASTY IN THE COALSHED

—*Manchester Guardian*, 2nd October, reporting the discussion on the London Fog session.



The Flood of Press Cuttings

The above chart shows the average number of Press Cuttings (relating to the Society and smoke generally) received *per month* during each of the periods indicated. It will be seen that in 1946-47 about 60 cuttings per month came in, and 1,000 during the month of October, 1953. (The November rate is even higher). Three points of interest are: (1) the steady rise in Press coverage from 1946 to 1952; (2) the relatively small effect of the London fog at the time it occurred, and (3) the sharp rise since then, culminating in October with the Society's conference, the smog mask story and other air pollution news. A record of 450 cuttings for the Glasgow conference came in (many in September). Not only has it become difficult to cope systematically with the flood of cuttings but the cost is becoming serious.

The Domestic Appliances Industry and Fuel Usage in Great Britain

The Melchett Lecture of the Institute of Fuel was this year (on 7th October) given by Dr. Harold Hartley, C.B.E., D.SC., HON.INST.GAS E., F.INST.F. *We print below excerpts from the lecture that are of special interest in relation to the study of the domestic smoke problem. For reasons of space it has not been possible to include the introductory paragraphs and the sections that relate to cooking, water heating and the design and manufacture of appliances. The lecture appears in full in the November, 1953, issue of the* JOURNAL OF THE INSTITUTE OF FUEL.

Space-heating

The bulk of the domestic space-heating is done with solid fuel and it has been variously estimated that 98 per cent.* of " main " living rooms are fitted with coal- or coke-burning appliances.

For bedrooms some 25 per cent. of the population appear to depend on gas or electricity for the occasional heating needed.

The adaptation of appliances for heating has been determined by the climatic conditions and by traditions. During the eighteenth century, with the expansion of ironfounding, a change was made from an earlier practice which has had a bad effect, and to which attention will be drawn later.

There is little public appreciation of the advantages of using convected heat. Central heating has found little application in the home, although it is a commonplace in countries with severer climates. Portal houses were provided with closeable solid-fuel fires with an easily controlled rate of burning, giving the advantage of reduced ventilation and the benefit of convected heat. These fires are more efficient than either the old or the modern type of grate, and their reception by the occupants raised hope that they would sound the knell of the built-in open fire.

Little has been done to make known the advantages of using self-contained appliances giving radiant and convected heat, and progress has been hampered by the national housing policy. A big effort will be needed to break down public inertia and to make people realize that the ideal heating system is really one of which the room occupants are almost unaware. It is not one that has to be the focal point of the family circle and may limit the utility of the living space provided.

Heat Absorption by Chimneys.—It is common knowledge that a substantial amount of heat is transmitted to the chimney by the flue gases passing away from an appliance. Little has been done, however, to estimate the temperature gradients and to take advantage of the fact. A year ago, in the William Young Memorial Lecture,† results were quoted of an examination made of the heat content of flue gases at different levels. The data obtained permit of calculation of the heat losses up to any level in the chimney.

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* The Coal Utilization Council has stated recently that this 98 per cent. is subdivided as to 67 per cent. open fires, 24 per cent. ranges or combination grates and 9 per cent. other types of apparatus.

† Annual General Meeting, Scottish Association of Gas Managers, 11th September, 1952.

The rate of absorption of heat by the chimney is of interest and suggests possibilities for improvement of appliances and of the methods of use.

The Fireplace Recess.—During the Middle Ages, when wood was the primary fuel, the fireplace often consisted of a recess, from the top of which a chimney led into the open air. The fire was built on the floor of the recess or in an open basket and re-radiation of heat from the surrounding walls made a substantial contribution to comfort. The use of coal as the source of domestic heat led ultimately to the modern practice of limiting the space provided for the fire itself, and of adding an ornamental but otherwise useless surround to close up the remainder of the fireplace recess. This restriction of space has seriously limited progress in the design and use of the solid-fuel fire, and has had a bad effect also on the design and use of the gas fire.

By making the fireplace a recess with a well-designed source of heat standing freely in the middle, a substantial improvement in efficiency is attainable without constructional complications. Merely by standing an ordinary gas fire in such a recess the heat output would be increased by 20 per cent. or more in the form of convected heat. Such an arrangement was included in experimental houses designed and built in collaboration with D. E. E. Gibson in Coventry some years ago, and was also demonstrated to a large number of architects in a Midland factory. The provision of fireplace recesses would do much to enable better use to be made of solid fuel and gas for space-heating, and also encourage the early manufacture of self-contained apparatus in which bituminous coal could be burned smokelessly.

Free-standing Fires.—In 1939 A. F. Dufton described a simple form of solid-fuel fire, referred to as an adaptation of the Cheminée de Nancy, which he had made to improve the heating of a living room. The fire, which was placed in a typical recess, emitted both radiant and convected heat. With it he found the coal consumption could be reduced from 3 lb. to 2 lb. an hour. Recently, J. S. Hales has recommended the use of a similar type of fire but with an adjustable flue restrictor and reduced grate area; the self-contained appliance to be designed for sealing to the top of the firebrick back of an existing built-in fire. The sealing may offer practical difficulties and if this is faulty the appliance will not be effective. The proposal should be given a large-scale trial and every effort should be used to make it a success. The Ridley Committee has endorsed the suggestion.

The use of such fires will act as a palliative, but their cost may be appreciably greater than that of low-cost grates. It will be influenced very much by the public demand, which has yet to be created. Whose is the responsibility to educate the public, and demonstrate to housing authorities the advantages of a change of fireplace design?

Radiant and Convected Heat.—Although much data have been published of the emission of heat from various types of apparatus, the value of the information is not always recognized. There is a failure to distinguish adequately between the effects of radiant and convected heat, and to analyse in detail the results attained with appliances providing the heat in one form or the other.

Some of the advantages of a source of radiant energy for the rapid attainment of comfortable conditions over a limited area have been known for many years. In 1925 Fishenden and Willgress published the results of experiments in which radiant intensities were determined corresponding to comfort conditions over a range of air temperatures. Further work has been done more recently by Bedford and others, but the significance of this body of knowledge has not always been recognized in planning some of the investigations which have been made.

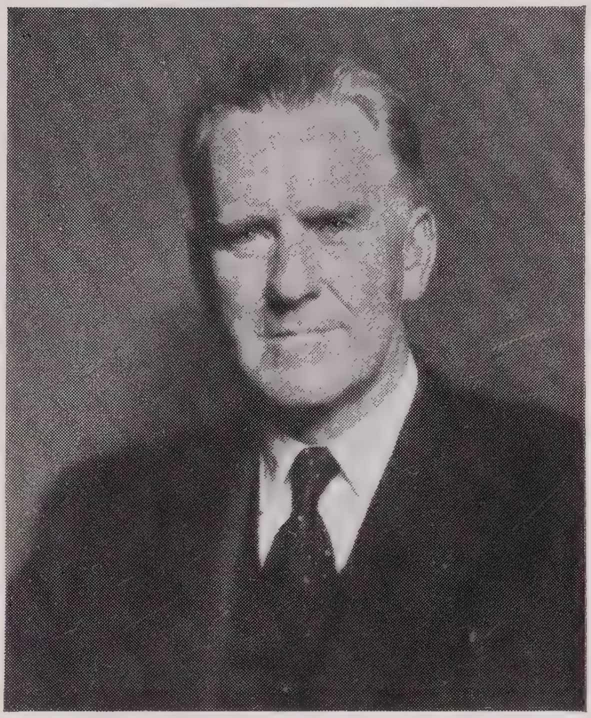
In this country space-heating is most often discontinuous, and insufficient attention has been paid to the implications of intermittent usage of appliances. A helpful contribution is to be found in a recent paper by D. R. Wills, in which the variable nature of domestic heating needs is analysed in an informative manner.

Then again, there is need for a better appreciation of the significance of temperature variations throughout a room.

The efficacy of an appliance should be a measure of the ability to maintain with it the desired comfort conditions in the occupied parts of a room, and particularly up to, say, 4 ft. to 5 ft. from the floor. Dufton by his work probably came closer to a true evaluation of room heating efficiency than have some later workers. His method, which takes into account both the temperature distribution within the room and the effect of the rate of air change, has much to commend it.

Insulation and Ventilation.—There is a growing appreciation of the importance of better structural insulation of houses and of the need to prevent excessive ventilation for maintaining comfortable conditions. The gains possible are well established, but there has been a delay in the application of the information which is, from the technologist's point of view, common knowledge. This delay may be attributable to preoccupation with the initial cost of building, and to indifference to the factors affecting fuel usage.

The adoption of improved insulation appears to be more extensive in the northern half of England and in Scotland, but the proportion of new houses insulated to the Egerton standard is inadequate. It is understood that in the north about one-half of the houses now being built have ceiling insulation up to the Egerton standard. Somewhat over one-third have an improved outer-wall insulation, although not up to the Egerton standard, but practically all reach the Egerton standard of insulation at the ground level by the use of a solid floor.



Dr. Harold Hartley
From the Royal Academy portrait by David Jagger, R.O.I.

Building costs have been reduced in some cases by the use of light-weight concrete blocks, which helped to offset the cost of ceiling insulation. By insulating a house to the Egerton standard, a reduction of 25 per cent. in heat losses from the structure can be effected, compared with those occurring in pre-war standard houses (11 in. cavity-brick outer walls, wood and joist ground floor, and tiled and felted roof).

Quite important economies can be obtained by reducing the effect of chimney pull, as is done in the most advanced form of convector gas fire with chimney-break attachment, and by reducing the amount of ventilation such as follows from the use of flue restrictors with solid-fuel-burning appliances. When an adjustable restrictor is provided in the flue outlet, it is suggested that an " hygienic " test should be applied before approval of appliances, lest fatalities occur due to carbon monoxide poisoning when smokeless fuels are used. Such a test has been applied to the gas fire ever since W. R. Twigg made his recommendations some 40 years ago.

Smoke.—In the section of the Ridley Report dealing with smoke abatement, three main sources of smoke pollution are quoted; the first is defined as:

> " The millions of houses which use raw coal burnt in old-fashioned open grates as the main source of heat comfort " . . . " producing a million tons of smoke (a year) . . . "

The Ridley Report was published in September, 1952. In December of that year there followed the latest London fog disaster, which a writer in the *Lancet* described as " a violent and untimely epidemic " which . . . . . " smote the people of London."

It can be stated definitely that most of the technical problems associated with the burning of bituminous coal in the home, virtually without smoke production and at high overall efficiencies (70-80 per cent.), have been solved. Coal-burning domestic appliances with which such results are achieved have been marketed for some years. Up to the present the application has been made for the provision of whole-house heating and hot water. The principles used in the fire-pot construction can be applied to other domestic apparatus, which, however, may only be manufactured if a worth-while market becomes available.

An Appreciation of the Domestic Fuel Problems

In the foregoing comments on appliance design, manufacture and use, no reference has been made to much work of significance done during the last 40 years. In view, however, of the present drift and confusion of thought, use will be made of the time remaining to put before you an appraisement of the problems of domestic fuel usage and a method for dealing with them.

Economy or Psychology. — The Simon, the Egerton, and the Ridley Reports, which include a great bulk of relevant data, have a common inspiration, deriving as they do from the economic conditions forced upon us by the war. The Ridley Committee expressed the view that the " right " pattern of domestic fuel use must be determined in relation to the cost of the fuel services (capital and operating), and have concerned themselves much with this aspect of the matter.

Because domestic fuel usage has been viewed so often as an economic problem, it may be overlooked that to an important extent also it is psychological. It exists in part because people have not been able to do, and now may offer some resistance to doing, what is technically and economically right. This unwillingness may derive from tradition and will continue until those having authority appreciate thoroughly how desirable a change of habit is, both for the private individual and in the interests of the national economy, and how the change can be effected.

The existing standards of comfort are now a minimum, and the ever-present desire to raise them will counteract exhortations to economize fuel in the national interest. The urge to better one's condition is selfish and, except in times of crises, self will come first.

The technical aspects are in general of little interest to the ordinary domestic user, whose innate conservatism offers resistance to change. This can best be overcome by education and by direct appeal to personal pride in the home, and by stimulating a desire to possess the most up-to-date and labour-saving equipment.

Much housework is monotonous, and because the use of gas or electricity is so convenient the householder is prepared to pay for the advantages they offer. The services obtainable help to satisfy the desire to raise the standards of comfort and leave time for relaxation. After a certain raising of the standard, the wish to procure equipment for the enjoyment of relaxation becomes insistent and offsets any urge to invest in better apparatus for heat services. Today, for example, ownership of a television set appears to many people as more desirable than, say, the possession of an improved hot-water system.* Where the home is the focus of family life, however, there will be a willingness to reduce the work of the housewife, and a desire to enjoy a degree of comfort limited only by the ability to pay.

At times expression is given to such sentiments as " We must press for the development of more efficient coal-burning space-heaters." Rarely, if ever, is there such implied criticism of gas or electrical appliances, yet the same intelligences are applied to their production as to that of solid-fuel apparatus. Wherein, then, lies the difference, because the using of coal in the home is on the whole done badly? The required knowledge for improvement of design and capacity for manufacture are available, but progress is hampered by a lack of adequate arrangements for approval, marketing and use, and all that these involve.

The Significance of the Domestic Outlay for Heat Services.—The heat services available in many homes are quite inadequate, and yet the operating costs are not serious even for " industrial " families. According to the latest Blue Book, in 1952 the national expenditure on beer amounted to £563 millions, on tobacco to £821 millions, and on fuel and light to £438 millions. This latter outlay is equivalent to an average annual household bill of approximately £30—about equal to the cost of ten cigarettes a day for each household.

The annual capital expenditure on new appliances is also relatively small and averages about £4 10s. per household—in the alternative " currency " less than ten cigarettes a week.

The mass of the public can and will spend more money for the purchase and use of better heat service equipment provided it can be obtained and used as tenants' fixtures. It needs only straightforward selling to bring this about. A £20 cooker can be obtained for an outlay varying from 1s. 3d. to 2s. 3d. a week, according to the period of hire-purchase. A " utility " solid-fuel fire, such as has been mentioned earlier, should be obtainable for only a few pence a week.

Of the £438 million spent annually on " fuel " as much as £260 million's worth may be wasted. Even after making allowance for avoidable waste by users, which may be serious, there is an ample margin for an important national saving of fuel. If matters are dealt with realistically, standards of comfort can be raised in such a way that fuel will be saved without an undue call on the domestic income or on the national resources.

Houses.—To use fuel more effectively, a start should be made with the house itself, wherein lies a crux of the problem. The use of heat service equipment is essential, and in building houses this should be recognized.

Houses should not be erected in which the insulation is below the Egerton standard and it should be ensured that there shall not be excessive ventilation.

Attention has been drawn to the desirability of reinstating the fireplace recess. Where there are flues—and more than one should be fitted to each house—they should permit the use of self-contained appliances.

By providing an equal opportunity for desirable competition, as has been urged by the Ridley Committee and the nationalized industries, better appliances will be made and marketed and improvement of fuel usage will be greatly stimulated. There cannot be adequate competition unless houses are designed so that the occupants can really choose between solid fuel, gas or electricity for providing any of the heat services needed.

The national resources are being strained to satisfy the demands of various sectional interests for capital equipment, and an increased total annual outlay on new houses may not be permissible. In view of the striking progress that has now been made in overtaking the demand for new houses, would it not be better if the rate of building were reduced by, say, 10 per cent. and more were done to improve the structures themselves?

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* During 1952, 794,000 television sets were retailed for £64 millions. During the first half of 1953 the corresponding figures were 517,000 and 39.3 millions.

It would be better also if none of the heat service appliances was included with the house: the ingoing tenant should acquire for himself self-contained equipment which would remain his property.

If these things were done, then a real start could be made to obtain a permanent improvement in fuel use.

The Significance of Tenant's Fixtures.—The improvements which have been made in gas- and electricity-consuming apparatus owe much to the fact that the demand is for self-contained equipment. Gas and electrical appliances are complete units, and their satisfactory installation is not dependent on other trades. Poor installation is often responsible for faulty working of built-in solid-fuel appliances.

Self-contained solid-fuel appliances, more efficient in operation, can be made; appliances for heating, cooking and hot-water supply which will allow of smokeless burning with bituminous coal and which will need little stoking and ash removal. They will not be produced economically, if at all, unless there is an adequate market. The technicians are better able to design, and the manufacturers to produce, reliable equipment when it is a complete unit. Further, such apparatus can be installed in a house so that it does not become a landlord's fixture.

Of the 13½ million dwellings in occupation, only about four million are owned by, or are in the process of being bought by, the occupants: two-thirds of the house-holders of the country are tenants. They can be induced to purchase tenant's fixtures and to take a personal interest in the use of appliances. Also, in due course, they would buy replacements when the design has advanced enough to make further expenditure worth while. By increasing the public demand for good equipment, marked improvement in fuel utilization will follow.

Education and Service.—Who is to do the preliminary work of educating the public and who is to see to the adoption of more effective apparatus? Appliance manufacturers have built experimental houses and altered old houses to stimulate interest. Their resources are limited and they cannot approach these matters as philanthropists, although in promoting their own interests they can, and do, help the nation. After all, it is only what is good for the nation that can in the long run be good for the appliance manufacturer, so he has every incentive to help progress to the best of his ability.

It is only during the last quarter century that any of the fuel industries has directly helped the appliance industry to create conditions favourable for progress. In this respect the gas industry went ahead owing to an earlier appreciation of the significance of the fact that its undertakings are public utilities, with a duty to supply not merely a commodity but a service to the public. The domestic demand for gas is maintained because the industry does much to ensure that the service obtained by the consumer shall be good. The electrical industry views its responsibilities in a like manner, and the appliance industry has taken advantage of the co-operation offered by both. The Coal Board, thanks to its scientific advisers, is beginning to play a helpful part, which it is hoped may grow as its experience evolves.

Approval and Marketing.—The marketing of gas and electrical equipment is guided by the nationalized industries, which buy in bulk. Well over 90 per cent. of the domestic gas appliances for the home market are sold through the showrooms of Area Gas Boards, and their approval of equipment is required before it is offered for sale. Before appliances are accepted by either of these industries, they are submitted by the industries themselves to tests agreed in collaboration with the manufacturers. These tests call for high standards of production and performance, and ensure, so far as is humanly possible, the safeguarding of the interests of the consumer. This does not apply to many of the products in which the coal industry is interested.

A few years ago the Ministry of Fuel and Power issued approved lists of solid-fuel equipment for use by local authorities, and in consequence there has resulted some improvement in the design of apparatus. Such control as these approval lists effect applies only to equipment purchased by local authorities, whose interest at present is limited to the new houses. There is little to stop the sale to private individuals of appliances which do not satisfy approved standards.

So long as there is a market for equipment which will not satisfy desirable technical standards, poor apparatus will be offered for sale; and the practice is contagious.

The cheapest-is-best state of affairs existed some years before the last war, and in those days relatively little research work, aimed at improvement in the design of solid-fuel apparatus, was done by manufacturers; or by anyone else for that matter. It would be unfortunate if there were a reversion to those conditions, as inevitably it would result in a complete loss of the valuable domestic market for coal. Domestic consumers spent £187 millions on coal in 1952.

The coal industry should not leave the responsibility for the design, manufacture, marketing and use of domestic coal appliances so much to the appliance manufacturers and the merchants, but in its own interests should assist to a greater extent. No fuel is of use to the householder without satisfactory appliances. It should be a primary concern of the provider of fuel to help to make it possible that only satisfactory equipment will be manufactured, and, as a *sine qua non*, to co-operate with the manufacturers and the merchants to ensure that a market, which is adequate, shall be offered only good equipment.

It is more difficult to design appliances for use with solid fuel than for use with gas or electricity, and yet it is in the solid-fuel sphere that the least has been done to organize the approval on an industrial basis.

Insistence on the adoption of high standards of production and performance for appliances is a necessary preliminary to improvement in the use of coal. Arrangements should be made by the coal industry itself for the testing of equipment, so that matters shall be cleared with the drive and sense of urgency which is essential for any organization which has to work for a competitive market. Appliances for space-heating, for cooking and for water-heating will need to be handled expeditiously by adequate staffs competent to deal with each section and to cope with the numbers of appliances submitted for approval. It is so important that this work be done by the coal industry itself, which as a result would get into closer touch with realities. It would attain a better appreciation of the potentialities and the limitations of appliances and of their manufacture, and be better able to assess the requirements and the opportunities for the successful use of coal in the domestic field.

The Importance of an efficient Appliance Industry.—It is in the interests of the nationalized fuel industries to have an efficient appliance industry, made up of firms which contribute to the fund of technical knowledge and use modern methods of production or control; of organizations appreciative of the need for, and of the steps to be taken to satisfy, high standards of production and performance. When it is ensured that high standards shall be satisfied, only efficient producing and marketing organizations will continue to exist; and efficiency is not determined by size.

The practice followed by the gas industry during the last quarter century has been effective. With the best will in the world, gas appliance design and production could not have been developed to the extent that has occurred, had the manufacturers not had the whole-hearted co-operation of the gas undertakings with whom, by agreement, standards of performance are determined and with whom potential markets are explored.

It would be a mistake to imagine that any particular fuel industry can always best satisfy any one of the heat service needs. Today these needs are met with appliances developed along certain established lines. Tomorrow, as a result of more background and applied research, new ideas will find application in the field. At the present time, for example, the bulk of the space-heating load is carried by the coal industry. If means are found of applying the principles of the heat pump to equipment which can be used in houses, it will have a striking effect on the balance of demand, and the electricity and gas industries might then begin to acquire a large portion of the load. It would be unwise to take any decision which would determine for years to come the direction in which development must take place. It is only by ensuring that the technologists shall have full scope for the use of their intelligence that the best progress will result.

> " It will never rain roses. If you want more roses, you must plant more trees."

THE NEW PRESIDENT

Sir Ernest Smith, C.B.E., D.SC., *Honorary Treasurer of the Society, was declared President at the annual general meeting in Glasgow on 2nd October. No other nomination was received. It seems hardly necessary to introduce Sir Ernest, who has been a member of the Society since its formation. As Dr. E. W. Smith he was present at the inaugural Buxton conference in* 1929. *As a Past-President of the Institute of Fuel and Chairman of the Industrial Coal Consumers' Council, Sir Ernest is well known, and is indeed a leading figure in the world of fuel. He is a graduate of the University of Manchester and was at one time Chief Chemist to the City of Birmingham Gas Department. Later he was Technical Director of the Woodall Duckham Company. Combining for the time the two offices of President and Treasurer, Sir Ernest is at present starting a personal appeal for funds for the Society, which has already met with good success and about which more will be reported later.*

New Vice-Presidents nominated and declared elected at the annual meeting are Mr. S. N. Duguid, until recently Chairman of the Executive Council, who was also among the small company at Buxton in 1929, *and Mr. Alex. W. Lee, Chairman of the West Midlands Division and Deputy Manager of the West Midlands Gas Board. The new Executive Council Chairman is Dr. W. R. Martine, Administrative Medical Officer of Health (General Purposes) City of Birmingham, and Hon. Secretary of the Midlands Advisory Council for the Abatement of Smoke and Atmospheric Pollution.*

" City of Smokeless Air "—Reykjavik

Professor Sir Ernest Kennaway, now working at St. Bartholomew's Hospital, recently made a visit to Iceland as part of an inquiry by the Medical Research Council into various factors that may be related to the incidence of bronchial carcinoma (cancer of the lung) in England, Iceland, Norway and Denmark. One of the purposes of the journey was to obtain records of pollution, by means of a smoke filter apparatus, at Reykjavik. Sir Ernest's report on his visit, of which he has kindly sent us a copy, has many interesting references to air pollution —or its absence—in Iceland.

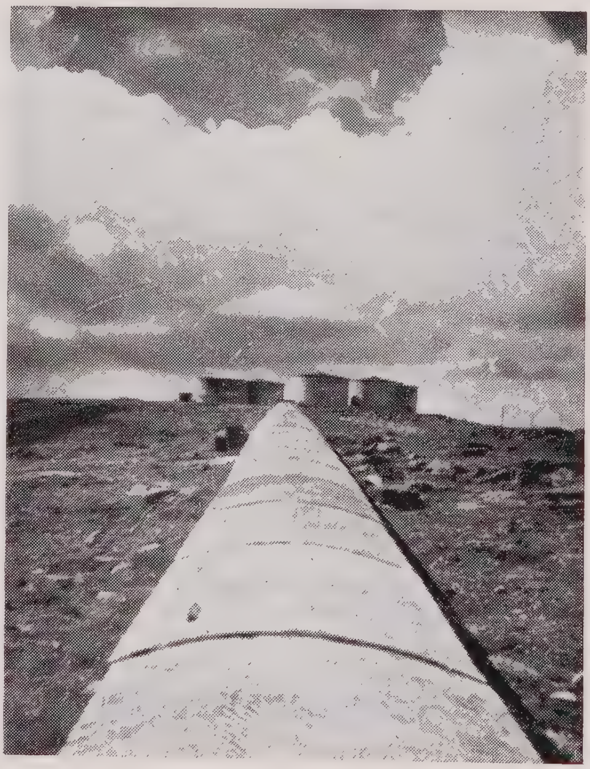
Iceland has no native fuel except peat and dried sheep's dung. Oil and coal must be imported. Three important sources of heat have been developed recently, and in the author's own words these are:

1. Water, heated by current supplied from hydro-electric stations during the night at a cheaper rate. This method is important at Akureyri where peat is no longer in use, and the new hospital there is heated in this way.

2. In Reykjavik, hot water is brought from 43 borings, begun in 1933, and two natural springs, at Reykir, about 10 miles distant; the water flows to a pumping station which propels it through steel pipes, insulated by turf within a rectangular cement conduit, to eight cylindrical holders, like oil tanks, which are conspicuous on a hill, the highest point on the outskirts of the town, from which it is distributed by gravity. The temperature, about 87°C. at the sources, has fallen by 2° to 3° on the way to the holders and then by 3° to 4° in transit to the most distant houses. Within a house, water for bathing and washing is taken first before entry into the radiator system, and finally the water passes into the sewer. The first houses were supplied thus in 1943; by 1947 the number was 3,000 and the system is spreading continually in the rapidly growing town; thus the side of the road on which we stayed had not yet received it, but it was installed on the opposite side. The city is recouping rapidly the initial cost of the system.

3. Another method of heating consists of an oil-fired boiler in the basement, which can be placed in a locked room, and when set in action by a switch upstairs, soon provides hot water in the bathroom and radiators. This system was installed in the house in which we lived, and is certainly very efficient.

These three innovations have replaced heating by coal, which formerly produced considerable smoke. Sir Ernest was told that at one time the sooty deposit on the snow was very noticeable, but now, during this eleven days in the city he did not see a single domestic chimney emitting anything visible, nor more than two non-domestic chimneys doing so—one at



The storage cisterns and main pipeline taking water from the hot springs to Reykjavik the harbour, and that of the hospital laundry, where coal is still used.

Other parts of this record are most interesting in the picture they give of life in Iceland, but space allows us to quote only two paragraphs, both of which may not be unconnected with the cleanliness of the air.

On cleanliness generally Sir Ernest writes: " Iceland never lacks water, and in many places hot water is available. Perhaps these facilities have encouraged a tradition of washing which makes Iceland, in so far as one can judge from a brief visit, a very clean country. In the chief towns, Reykjavik and Akureyri, this state of affairs is now assisted by the absence of soot-production noted above. The low incidence of cancer of the skin (four cases in the whole country in 1944-49, according to the Public Health Reports), usually attributed to the absence of intense sunshine, may be due also to personal cleanliness. The abundance of water is illustrated by the usual W.C. flush which seems to be about three times the customary $1\frac{1}{2}$ to 2 gallons of England."

Colour in Iceland has a paragraph to itself:

" Iceland is a country of many colours; those of the clear midnight sky in summer cannot be described or forgotten, and even the wild vetch of the pastures is of a deeper purple than it is with us. The people love colour; the commercial greenhouses warmed by the water of the hot springs produce not only such utilitarian crops as tomatoes and grapes but cut flowers in quantity; and when one goes north to Akureyri one finds that the scarlets of the children's clothing are even brighter than they are in the south.

" Iceland is a wonderful country and a visit to it, and to its people, is a very enjoyable experience."

Schoolgirls at the recent " Smoke and Smog " Exhibition, at the Royal Sanitary Institute, examining air filter pads from the Royal Festival Hall. This attractive and informative exhibition drew many visitors. A number of Government departments and organizations, including the Society, co-operated by the loan of exhibits

Air Pollution and the London Fog

A Paper by Dr. E. T. Wilkins, M.Sc., Ph.D.

AN informative contribution to the growing literature on the London fog of December, 1952, was given in a paper by Dr. Wilkins, Officer-in-Charge, Atmospheric Pollution Section of the Fuel Research Station, at a meeting of the Royal Sanitary Institute on 11th November, 1953.

Dr. Wilkins, in his introductory section, pointed out that smog disasters had previously occurred in Belgium and the U.S.A., but that the London incident was the first in which directly determined information on the pollution of the atmosphere, at the time of the fog, had been obtained—even though it did no more than provide a fraction of the information required for a thorough investigation.

On the frequency of fog in London, Dr. Wilkins said:

" Published data show that during 1941 to 1946 fog tended to be most frequent in London in December, January and November in that order. During those three months, fog with a visibility of less than 550 yards occurred on 23 per cent. of occasions and dense fog (visibility thirty yards) on 0.8 per cent. of occasions. At all seasons fog was most frequent soon after sunrise. During the six-year period the number of occasions of continuous fog lasting two to three and three to four days were six and two respectively.

" Smog incidents during the last eighty years which led to seriously increased mortality were reported to be dated as follows: 9th to 11th December, 1873; 26th to 29th January, 1880; 28th to 30th December, 1892; 26th November to 1st December, 1948; 5th to 9th December, 1952. On the basis of the number of foggy spells during 1941 to 1946 it is evident that during eighty years the number of occasions when persistent fog lasted more than three days must have been nearer thirty than five. This raises the question whether this fortunately low incidence ratio is due to meteorological differences, or to gross differences in the emissions of toxic substances, or to both."

On the extent and depth of the fog, Dr. Wilkins said:

" On the first day of the smog the approximate centre of the affected area, where there was also the lowest visibility, lay in the neighbourhood of Westminster. By the second day the affected area had become enlarged in all directions, but particularly westwards, so that fog or smog extended from the North Downs to the Chilterns (twenty to thirty miles) and along the Thames Valley to beyond Maidenhead (more than fifty miles). The depth of the fog or smog varied considerably from place to place and from time to time; at its fringes it was mostly at or below the 250-foot contour on the south side and the 400-foot contour on the north side. Blackheath, at a height of 150 feet, was reported at one time to be almost clear and the chimneys of Battersea Power Station (337 feet) were observed once to protrude through the smog with the plumes blown by an appreciable wind."

From a detailed examination and tables of the pollution records during the fog, discussed by Dr. Wilkins, some of the points that emerged are as follows:

Pollution possibly increased even before the arrival of the fog.

The highest concentrations of smoke were at County Hall (Lambeth), Westminster, Southwark and North Woolwich. At individual sites the maximum concentrations were between three and ten times the normal values, the greatest relative increases being mainly in the central areas.

Maximum concentrations of sulphur dioxide were at County Hall, Westminster and the City. At individual sites the maximum concentrations were between three and twelve times normal, the average being about six times.

Note is made of the tendency shown by the smoke and sulphur dioxide concentrations to rise and fall in parallel.

Comparisons made with the relatively severe smog of December, 1948, show that at a few sites the concentrations were greater during the earlier event, but that in general the maximum and mean concentrations of both smoke and sulphur dioxide were between 50 and 70 per cent. of the 1952 values.

Pollution rose in other towns during the period, even where no fog was reported: probably therefore inversion conditions were general even without persistent fog.

Discussion

We quote in full the discussion on the observations with which Dr. Wilkins concluded his paper.

The smog which enveloped London during December, 1952, showed all the usual unpleasant features in an exaggerated form; in particular it had unprecedented and disastrous effects on public health.

Following previous smog incidents in Belgium and the U.S.A., there had been speculation as to whether the sulphur dioxide content of the air on these occasions rose to dangerous concentrations, but no measurements were made. One of the most important results of the survey described in this paper is that from the results of regular measurements it is certain that at no time during the London disaster did the sulphur dioxide concentration approach the value of 10 p.p.m., which is the generally accepted toxic limit for an exposure of several hours. The observed daily mean concentrations nowhere exceeded 1.3 p.p.m. Even such values only occurred locally, and, in some areas, where many deaths were caused by the smog, mean concentrations reached no higher than about 0.5 p.p.m. On the basis of these figures it seems fairly certain that healthy persons would not have been seriously injured solely by the concentrations of sulphur dioxide which were present during the smog; on the other hand, it is known that many of the affected persons had previous histories of respiratory trouble.

It has been established in this investigation and others that the concentrations of sulphur dioxide and smoke in the atmosphere tend to increase and decrease together. On the assumption that there was a similar relationship between sulphur dioxide and other pollutants it has been estimated that the concentrations of carbon monoxide, carbon dioxide, and possibly sulphuric acid (although the evidence here is very conjectural) may each have approached or reached values at which slight physiological effects are said to occur.

The possibility that combinations of certain gases and vapours with aerosols may have toxicities far greater than those of the constituent substances, is one of the more recent developments in atmospheric pollution studies. A particular example of this " synergistic " effect, which has recently been studied in the United States, and which may be particularly significant, is an association of sulphur dioxide with sulphuric acid mist. Similar associations between smoke and oxides of sulphur may also be important.

The concentrations of sulphur dioxide during the smog period were up to about ten times those occurring in a normal December, but the pattern of pollution over the whole London area had the same general characteristics during the smog incident as normally. In each case the zone of heaviest pollution covered much of Westminster or adjacent boroughs, and there was a belt of somewhat lower but still relatively high concentration along almost the whole riverside area. In Westminster the smog seems to have appeared initially with the greatest opacity; this observation is consistent with the view that this area of maximum pollution provided myriads of additional condensation nuclei resulting in the formation of larger numbers of smaller fog droplets than elsewhere.

From the Fuel Research Station records it is evident that relatively high levels of pollution occur in Westminster at all seasons of the year. Under normal conditions this pollution, much of which has its source in areas to the south-west, drifts with the prevailing wind mainly over central London and the areas to the east and north-east.

Since the smog of last December was more disastrous than any that had happened for at least eighty years the question arises whether its occurence was due to a freak meteorological condition or to changes in the character or amount of any particular pollutants or to both.

The observation that the fog in some of the seriously affected riverside areas appeared on occasions to reach no higher than 150 to 300 feet may explain the rapid accumulation of pollutants to relatively high concentrations. In connection with possible " unusual " constituents of the atmosphere mention may be made of two factors which may be worthy of further consideration:

(i) Sulphur trioxide, and the sulphuric acid mist which is formed from it by the absorption of water from the atmosphere, occur both as a result of direct emissions from some fuel-burning installations and by the subsequent oxidation of sulphur dioxide in the atmosphere. This latter reaction is probably more pronounced during conditions of fog because of the longer period of retention and the presence of liquid water droplets; it also proceeds more quickly in the presence of certain catalysts which may consist of oxides of nitrogen or certain types of particles, both of which may be discharged by modern high-temperature coal-fired furnaces. Small amounts of ozone produced by electrostatic dust-collecting installations may also promote the oxidation of sulphur dioxide. Modernization may thus involve an increasing pollution of the air by sulphuric acid mist both normally and during smog.

(ii) Many Londoners commented on the exceptionally sticky or tarry nature of the grime which settled from the smog. During the last year or two a type of domestic open-fire, which is designed to stay alight all night, has come into extensive and increasing use. Some of these fires are regularly banked-up with coal when the householder goes to bed so that some smoke and distillation products are emitted to the atmosphere during the night when the type of grate which most of them have replaced would not be alight. Tests at the Fuel Research Station have shown that under comparable conditions both types of grate produce about the same amount of smoke, so that on a twenty-four hourly basis the all-night-burning grate produces the more smoke. Furthermore, this additional smoke is produced at night when the meteorological conditions leading to fog formation are more prone to occur.

Enquiries have indicated that the number of all-night-burning open fires in operation at night during the winter of 1952 was small. However, their popularity seems to be maintained and their numbers are increasing so that any effect which they may have had in the past, even though it may have been small, may increase in the future.

The bad effects of air pollution are, of course, not confined to periods of smog, for there is evidence that even the lower concentrations normal to many densely populated areas have persistent and insidious effects on public health, vegetation and on materials of all kinds. Thus the problem of smog is, in some respects, a short-term magnification of the general problem of atmospheric pollution, and because the effects of normal pollution are ever present they undoubtedly represent, in the long run, a greater damage and loss to indivduals and to the nation than does an occasional smog incident.

To convert London and other polluted areas into smokeless towns will require great changes in the manner in which fuel is used, so that, even with the maximum of scientific achievement, financial resources and public co-operation, it can only be considered as a long-term objective. If the objective is widened to include the elimination of pollution by sulphur compounds the problem becomes even more difficult of solution.

The absence of any obvious solution to the problem of preventing the emission of sulphur should not, however, be a reason for delaying arrangements for smoke elimination. Earlier in this paper reference is made to the possible composite effect of pollutants which may be very much less harmful individually than they are in combination. It may be, therefore, that smoke and sulphur compounds make a dangerous combination of this kind and that a reduction in smoke would also render the sulphur compounds less toxic and destructive. Long-term plans for providing greatly increased supplies of smokeless fuels are therefore a prime necessity if the general problem of pollution is to be tackled on a national basis.

In the meantime it is necessary to consider any expedients which might be used to minimize the production and the harmful effects of smog and atmospheric pollution generally. In this connection the following observations are offered as a basis for discussion:

(*a*) *Smokeless Zones.*—The selection of areas to be made in accordance with scientific assessments of the benefit likely to result from a smokeless zone. A smokeless zone, unless very large, tends to improve the amenities of its down-wind neighbours rather than its own.

The present paper has shown that the most heavily polluted area in London is Westminster. If a smokeless zone were instituted in this and other areas to the south-west, including all or parts of Fulham, Chelsea and Kensington, not only would Westminster, with its priceless national architectural treasures, benefit, but also the city and other parts of London on the down-wind side.

(*b*) *Incentives.*—Much of London's smoke is of industrial origin, but most comes from domestic open fires. If any great improvement is to be effected household fires must be smokeless. This may require more tangible incentives to the householder to use solid, and other, smokeless fuels.

(*c*) *Smog Measures.*—Householders who normally have to use bituminous coal on open grates should be encouraged to maintain a few days' supply of smokeless fuel for use during fog.

(*d*) *Banking-up Fires.*—Methods of banking-up coal fires at night with domestic boiler fuel (or other smokeless fuel) or ashes might be perfected and publicized.

(*e*) *Invalids.*—For the protection of bronchitis, etc., during smog incidents it should be possible to design emergency air-cleaning devices for use in hospitals and homes.

Farmers Driven Away by Smoke

Because of the damage to pastures caused by smoke pollution, West Riding farmers were leaving their farms, Mr. R. B. Latham told members of the Wakefield branch of the National Farmers' Union at Wakefield.

Stop Press Review

THE INTERIM REPORT

The Interim Report of the Government Committee on Air Pollution, (H.M. Stationery Office, 1s. 6d.) has been published as this journal is being printed and a full review will have to be deferred until the next issue.

The Report is a short, workmanlike survey of the present situation, which of necessity contains little that is new. It does, however, show that if the Committee has not yet moved very far it is at least looking in the right direction. It is a matter of satisfaction that the Report, by and large, should be an endorsement of the case for action against air pollution that has for so many years been advocated by the Society.

An early paragraph is important: "Both medical opinion and chemical investigation indicate that the deleterious effects of the oxides of sulphur are greatly enhanced by the presence of smoke particles and our conclusion therefore is that *the first objective should be to prevent the emission of coal smoke and oil smoke*, and of grit. By smoke we mean solid particles of soot, fine dust and minute liquid droplets of tar and oil."

The need for smokeless fuels is fully stressed and it is pointed out that little has been done to implement the Simon Report recommendations of 1946 in this respect. It is believed that it should be possible to provide within only a few years sufficient smokeless fuel to supply all the worst areas. Not a great deal is said about industrial smoke, but there is one extraordinary error of fact. It is said that "In 1942 courses for training of boiler-house staff were started . . ." Such courses were in fact begun, at the instigation of our parent body, the Coal Smoke Abatement Society, at the Borough Polytechnic, as long ago as 1907.

Smokeless zones are favourably mentioned, and a new figure of interest is an estimate of the weight of carbon monoxide emitted each year from chimneys and vehicles—24 million tons.

A NEW TEXT-BOOK

Public Health Engineering by Peter G. C. Isaac. E. and F. Spon Ltd., London. 36s. net.

This text-book will be of interest and assistance to many of our readers, dealing as it does most thoroughly with many questions of public health that are essentially or in part matters of engineering. The scope is indicated by the chapter headings—water collection, quality, treatment and distribution; sewerage; river pollution and trade waste waters; refuse disposal, atmospheric pollution and district heating. Only the last two, or perhaps three, chapters are of direct concern to this journal, and both are admirably informative, up-to-date and succinct accounts of the subjects.

Mr. Isaac, lecturer in Civil Engineering, University of Durham, King's College, Newcastle upon Tyne, spent a year in the United States, studying at Harvard under Professor Fair, who contributes a foreword to the book.

The Housewife and her Smoke Costs

The Electrical Association for Women has been carrying out a survey, by means of a simple questionnaire, to gain an indication of the effect of air pollution on household running and household budgets. The questions have concentrated on the one item of laundry done at home—rather on the lines of the classical Manchester-Harrogate inquiry of thirty years ago. The results of this commendable inquiry, which it is hoped will show the differences between clean and smoky areas, will be of much interest.

OIL FIRED FORGE FURNACES

TEMPERATURE CONTROL AIDS SMOKE PREVENTION

From a Paper by H. Southan to the Willenhall Smoke Abatement Advisory Committee on 13th April, 1953.

THE design and construction of Forge Furnaces is relatively simple but the problem is not quite free of complexity, as many people would have it; there are a great number of people who still consider our furnaces as simple boxes of brickwork which can be built by the cheapest of unskilled labour. This opinion is, to my mind, quite out of date and in these days of required greater economy, it is surely a good policy to devote more research to the field of heating for forging, so that our furnaces may be made to work as efficiently as possible.

For centuries I suppose it has been necessary for man to use his eyes to determine whether the piece of metal was heated to the correct temperature and it has always been difficult to convince many skilled and highly practical people that it is possible to obtain improved temperature control through the use of control instruments. As far as our industry is concerned, it is only in very recent times that the importance of furnaces, their design and operation has come to be realized to its fullest extent. Before this time it was known that improper heating for forging was responsible for a great many defects present in our finished products, but nothing much was done about it. Today, however, there is a great wealth of information becoming available with regard to this matter, and it is a comforting thought when one considers the ever increasing complexity of metals and alloys, and also of course, the stricter demands of our customers.

Unfortunately it is still common practice to work our forge furnaces at the maximum temperature which the refractories will withstand, and to judge by eye the temperature at which the bar is to be withdrawn from the furnace for forging. This practice is to be deplored, in that the life of our furnace becomes relatively short due to the production of much scale on the bar which drops to the bottom of the furnace and combines with the refractory to produce a liquid, or semi-liquid slag which so causes wear.

Slag is detrimental in all respects, one has already been given. It also accounts for bad surface condition on our finished product, and more important still it accounts for poor die life, a factor which a great many of us fail to remember although we know of it.

If furnaces are operated in such a manner, there is always the danger that over-heating or burning will take place, and if this is severe much time and money will be required to be spent on rectification, or indeed there may be a very real danger to life as in the case of highly stressed units for the aircraft industry.

Once again, working our furnaces in this way is usually accompanied by unsatisfactory working conditions particularly from the influence of smoke.

It is gratifying to realize that automatic temperature control is not only the success we have already spoken of, but it is also an efficient contributor to smoke abatement. It is all to the good that both combine so well towards better productivity and general health of the operatives and also, of course, to the general public.

Many of the adverse effects which may be attributed to uncontrolled furnaces are almost entirely eliminated by the strict use to automatic control.

There are other advantages particularly that of economy, but perhaps it would be better to leave these points for a little while and to tell you something about the actual method we are using.

It would probably be a good idea to break the installation down into two or three parts and perhaps it may be advisable to mention the thermocouple to start with.

The thermocouple may be briefly described as two dissimilar wires which have been joined together at one end and this point is known as the hot junction. It is this point which is inserted into the furnace and which does in point of fact form the basic item in controlling the furnace.

The thermocouple is enclosed in a sheath of refractory material to protect the wires which are of platinum and an alloy of platinum and rhodium and to the ends of the elements are joined special cables which are made to connect to a millivolt meter which is usually directly converted to a temperature scale. These so called millivolt meters are what are known as the controllers, one may have them either directly indicating or they may be of the recording type.

If we now imagine that the thermocouple is inserted into one of the sides of the furnace, or the roof for that matter, the wires will become heated and an EMF, or in other words a very small electric current will be generated at the hot junction, which will be transferred to the controller, and so a deflection of the needle will be obtained which will be in our case a direct indication of the actual temperature in the furnace at that point.

Next we should briefly consider the burner which is being used to pass the fuel into the furnace. The type of burner being used is a Rotovac, manufactured by Nu-Way Heating Plants of Droitwich, and is size No. 3 with a slightly reduced nozzle. This burner is of the low air pressure type and the air for combustion of the fuel is supplied by a centrifugal fan.

The fuel oil is made to pass through a jet and discharges itself into a high vacuum. The vacuum at the vortex is created by the rotational velocity of the air in the burner itself and performs the important duty of breaking the fuel oil up into a very fine spray or mist, which is then vaporized immediately it leaves the burner nozzle.

The vacuum created at the jet is proportional to the air velocity and plays an important part in automatic temperature control since it is partially due to this vacuum that the oil is withdrawn from the jet.

It is of utmost importance that all conditions at the burner should be as near standard as possible and under control. It is, therefore, essential to bring the oil to a constant viscosity by preheating, in our case we heat to approximately 190°F., the fuel being used is Shell Heavy Oil of 950 sec. Redwood No. 1 at 100 F. This preheating is done by immersion heater and is thermostatically controlled.

We will assume that our furnace is being started up for the first time and follow through exactly what happens up to the time it commences to be controlled.

The immersion heater will have been switched on previously and the oil will be ready at the correct temperature. The fan will be started and will blow air into the furance through the burner, thus causing the vacuum we spoke of earlier. The motorized valve is electrically operated and is in the fully open condition, so that we have a maximum vacuum at the vortex.

If we now introduce a little pressure to the tank through the needle valve which makes a connection to the main air supply and in between the motorized valve and the burner, and then open the main outlet valve of the tank, the effect of the high vacuum and of the pressure in the tank will be to start the flow of oil to the burner.

This flow of oil may not be sufficient and all that need be done is to introduce more pressure into the tank through the needle valve; this being the only control of the furnace it is possible to set the conditions of the furnace and leave for a period of, say 24 hours without further attention.

The furnace will continue firing at this set rate and while all this has been going on the temperature controller has been set to work or rather control at a definite heat, say for argument sake 1300°C.

As the temperature in the furnace rises so do we get an increasingly greater deflection of the pointer. When this pointer reaches a certain position which is in our case 1300, a mercury switch operates in the instrument which automatically operates the motorized valve which now begins to close.

The vacuum at the jet is decreased, and also the pressure in the tank is decreased and, therefore, much less oil is able to flow through to the burner. This principle is what is known as a high low flame condition. The temperature will now begin to fall in the furnace and this will be indicated on our controller.

However, as soon as the pointer shows a reading immediately below 1300 the switch operates again and in turn so does the motorized valve which then opens and the pressure in the tank is increased back to its old value and full rate firing is continued.

The amount of flame or oil entering the burner on low flame can also be controlled and set by means of an adjustment on the motorized valve, so allowing it to close to any desired amount.

One of the main advantages of controlling our furnace is the better product quality that is obtained, that is metallurgical quality. For example, almost complete avoidance of burning and over-heating, better structural condition in our forgings which are a result of working being carried out in the correct range of forging temperature, better surface condition due to the presetting of definite working conditions within the furnace, and of course, summarizing these things an overall reduction in product rejections.

The economical advantages which can be derived from it will now be considered.

It just so happens that the furnace we are controlling is working side by side with another of exactly similar size and construction, some details of which are as follows:

Interior dimensions 3ft. 10in. by 21 in. by 20 in. high with a capacity of 11.3 cu. ft., and hearth area of 6.7 sq. ft. Both of these furnaces are single sided with a sprung arch. The controlled unit works in conjunction with a 10 cwt. Massey Hammer of the automatic friction lift type. The other furnace of identical size works with a 15 cwt. Hammer of the same type.

The uncontrolled furnace consumes on an average six to six and a half gallons of oil per hour, for something just over 200 lbs. throughput per hour. The controlled furnace consumes 3 to 3½ gallons per hour for a throughput of just under 200 lbs. per hour, at any rate the furnace delivers heated bar as quickly as it can be used by the Hammer and this is probably the most important basic factor.

Now these two furnaces show a wide difference in consumption rates exactly in fact three gallons per hour, but we must take into account the heavier unit which the uncontrolled furnace is supplying. So that we may assume a saving of two gallons per hour which is very reasonable.

The cost of one complete installation, that is, the control tank, the motorized valve, controlling instrument, thermocouple, and other ancillary items is approximately £200. While mentioning cost, it is advisable to remember that a good class of burner is required and also the ability to maintain a standard air pressure at the burner.

Our outlay we may consider as £200, and our saving as two gallons per hour. We must remember, however, that there is a considerable saving to be derived from increase in life of the furnace which will not be dealt with here, as an accurate figure has not yet been arrived at.

This particular furnace is working 16 hours a day, therefore, that represents a saving of £8 per $5\frac{1}{2}$ day week on fuel oil alone. Looking at it over a year that saving becomes £390, and if applied to ten furnaces this figure becomes nearly £4,000.

Obviously a small reduction must be made to cover depreciation of plant, cost of repair, and maintenance to the installation, but one can say that this maintenance will only mainly concern the replacement of Thermocouples and Refractory Sheathing.

It is seen, therefore, that the installation under discussion has paid for itself during the first six months it was operated.

With a saving of only one gallon per hour, it would pay for itself within 12 months and it is my contention that there must be a great many of our forges where a saving of one gallon per hour per furnace is well within the realms of possibility.

THE B.E.A. REPORT 1952-3

British Electricity Authority: Fifth Report and Accounts, 1952-53. 8vo., pp. 238, H.M.S.O., London. 8s. 6d. net.

The British Electricity industry continues to expand but not quite so rapidly as in the previous year. 61,600 million units of electricity were generated, or 4 per cent more than in the previous 12 months or 47.3 per cent more than on vesting day. At the end of the year consumers exceeded 13,884,000—435,000 or 3.2 per cent. more than a year before, 2,170,000 more than on vesting day and nearly 4,000,000 more than in 1939. Sales of electricity were 52,250 million units, or 3.7 per cent. more than in the previous year and 47.2 per cent. more than at vesting day. Industrial consumption was 2.5 per cent. more than in the previous year, domestic 1.7 per cent. more and commercial 11.8 per cent. more. Sales to farms were up by 18.2 per cent. and public lighting by 9.0 per cent. Total traction sales were unchanged.

The average price charged for electricity was 1.311d. per unit or only 7.5 per cent. higher than the price at 1.220d. charged during the previous year in spite of the increases for coal and other materials and services used by the Authority. The combined revenues of the Authority and the Area Boards amounted to £285.57 million, being an excess over their combined expenditure of £7,280,823 and giving a total surplus during the five years since vesting day of £28,331,75.

At 31st March, 1953, the Authority owned 285 power stations varying in size from Barking of 597,000 kilowatts to small internal combustion sets of less than 100 kilowatts, giving a total generating capacity of 17,156,767 kilowatts and an output capacity of 15,535,000. Owing to shortage of plant it has been necessary to keep in commission generating plant old, expensive and inefficient. The maximum thermal efficiencies of generating plant is achieved at Littlebrook B (Dartford), 29.91 per cent. and at Dunston II (Newcastle-on-Tyne) 29,76 per cent. while the overall thermal efficiency of steam plant is 22.72 per cent. against 22.04 per cent. during the previous year. Seven new stations were brought into commission during the year: Bankside B, Baking C, Brighton B, Huncoat (Accrington), Keadby (Scunthorpe), Littlebrook C (Dartford), and Uskmouth A (Newport, Mon.), all except Bankside being fired by pulverized fuel. Extensions at 27 other stations were brought into operation.

At 31st March, 418 sets representing 15.2 per cent. of the steam capacity were 25 or more years old, while 413 sets representing 7.8 per cent. of the total capacity were less than 8,000 kilowatts.

The bulk of the plant envisaged in the current programme consists of standard 30,000 and 60,000 kilowatt sets. Larger sets of 100,000 kilowatts at 1,500 lb. per sq. in. at 1,050° F. is in view for Willington A station near Derby while 120,000 kilowatt sets at 1,500 lb. per sq. in. at 1,000° F. on a reheat cycle are being designed for Blyth and Drakelow (Burton-on-Trent) stations.

A 150,000 kilowatt gas turbine set was brought into operation at Trafford station, Manchester, for a number of experimental runs.

The major transmission works put in hand included 203 route miles of 132,000 volt lines and 372 route miles of the new 275,000 volt grid. The first section of the latter, 41 miles between Staythorpe (Newark) and West Melton (Sheffield) was in operation at 132,000 volts.

The Authority used 34.75 million tons of coal, 880,000 tons of coke, and 60,000 tons of oil and other fuels.

Load shedding occurred on nine occasions during the year, three in summer and six in winter, against 79 during the previous year.

The report points out that in view of increased capital costs and other fixed charges the steady and well-balanced expansion in the use of electricity to give a high load factor, is essential if the supply of electricity at reasonable levels is to be maintained.

The Authority has under constant examination the combination of power generation with the supply of heat for district heating which involves the rejection of more heat than would normally be the case. This would necessitate the provision of extra plant to maintain the same output in addition to heavy capital expenditure on mains.

—*A.J.C.*

" When oi lived here as a boy seventy year ago, mister, this was the prettiest little smokeless zone you ever saw."
—*Cartoon by Gus, with acknowledgments to the " Evening News," London*

A Widnes Report

The Medical Officer of Health and members of the Public Health Department have prepared an unusually comprehensive report on atmospheric pollution, which can almost be called a local Beaver Committee Report. All aspects of the problem are considered, observations and recommendations made, and a series of appendices gives useful technical and other details relating to the area.

One Hundred Years Ago

This had been an eventful year in the history of the metropolis. A bold attempt has been made to free London from the miseries of smoke . . . . "—From the *Annual Summary* of *The Times*, 1853.

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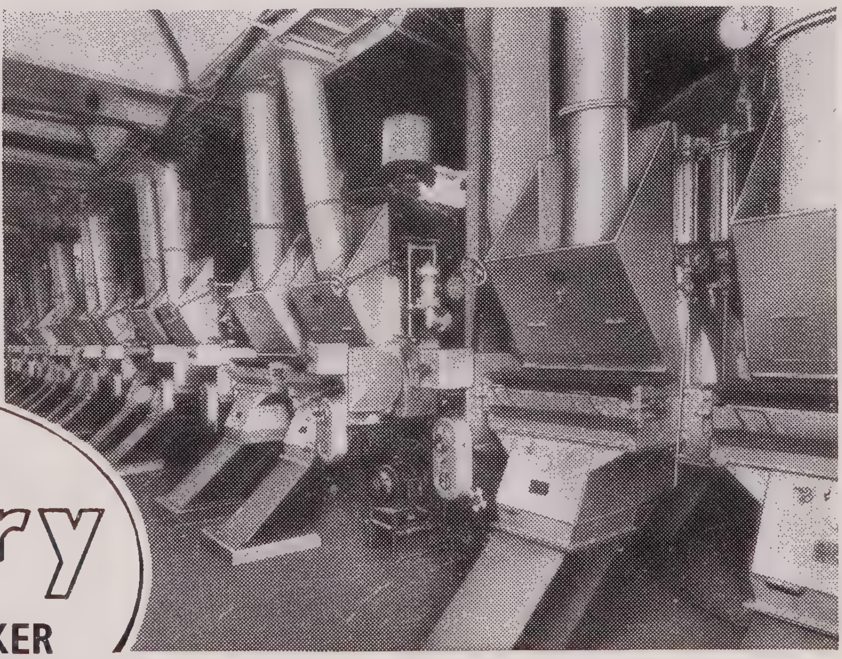

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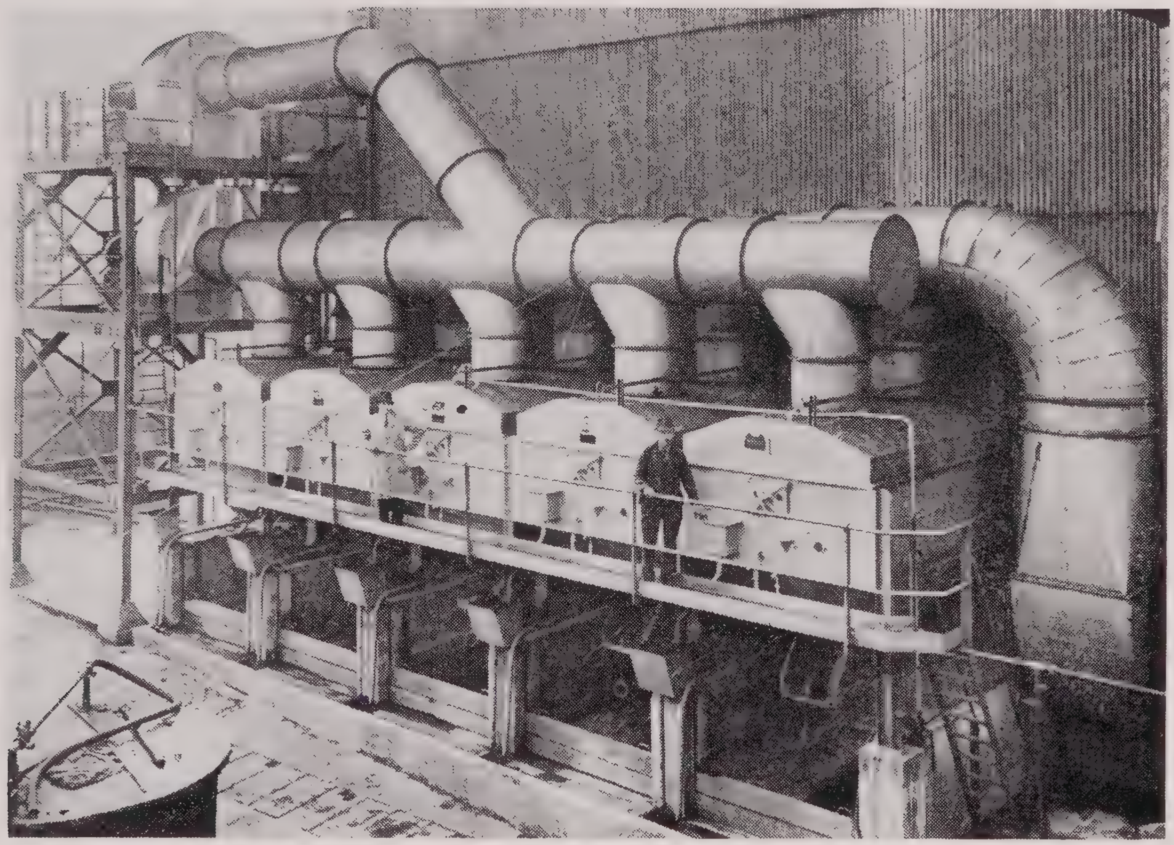

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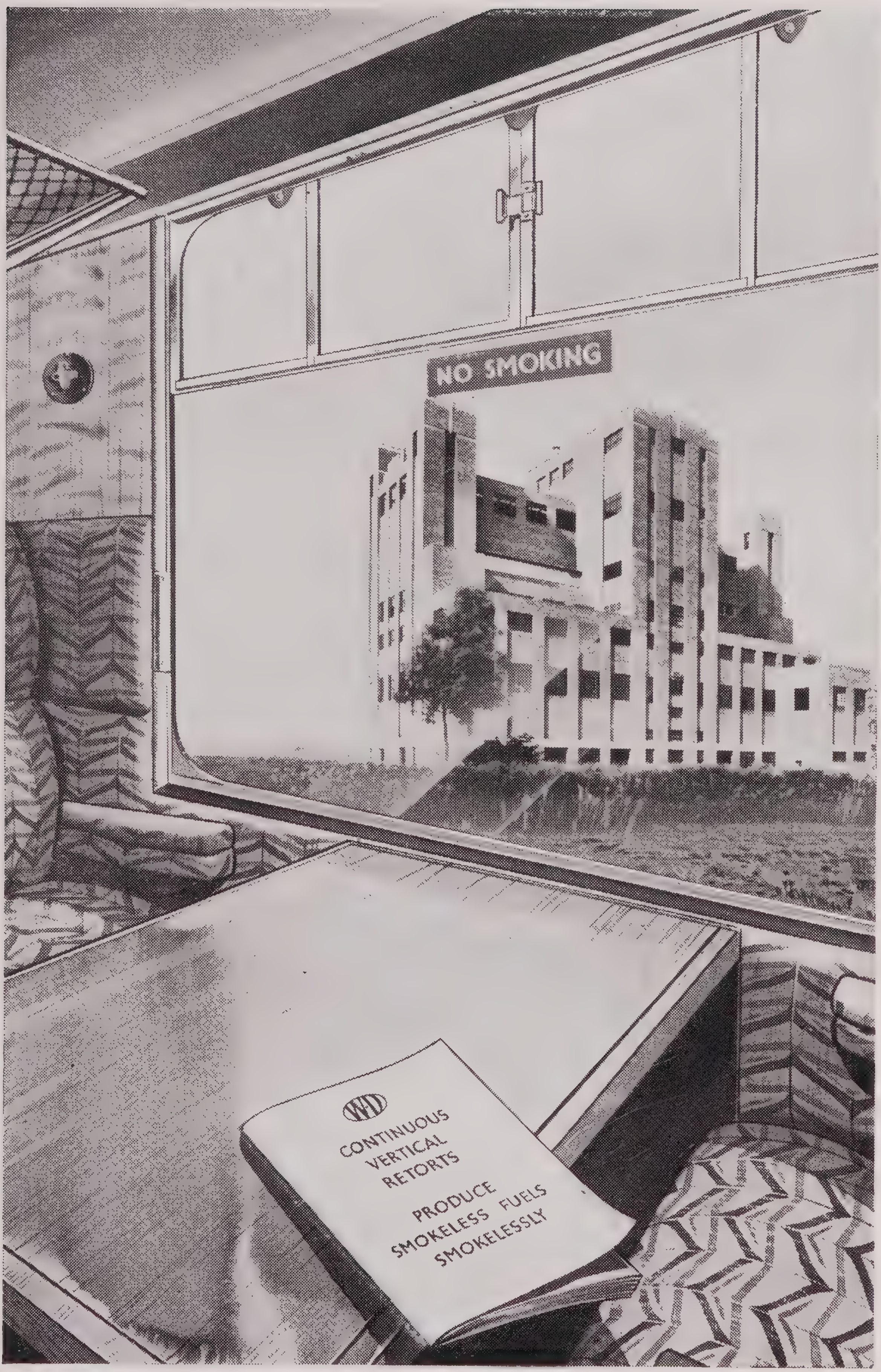
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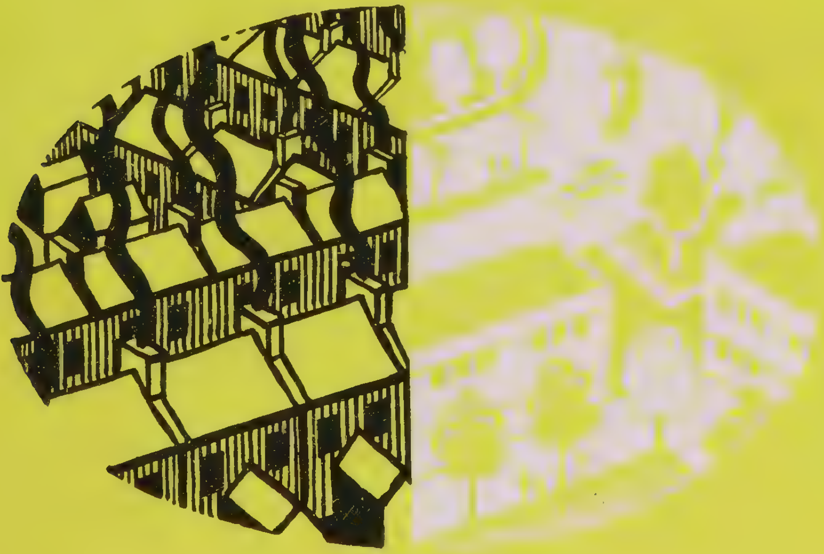
THE SMOKE ABATEMENT JOURNAL



No. 89 SPRING 1954

ONE SHILLING

In this Issue

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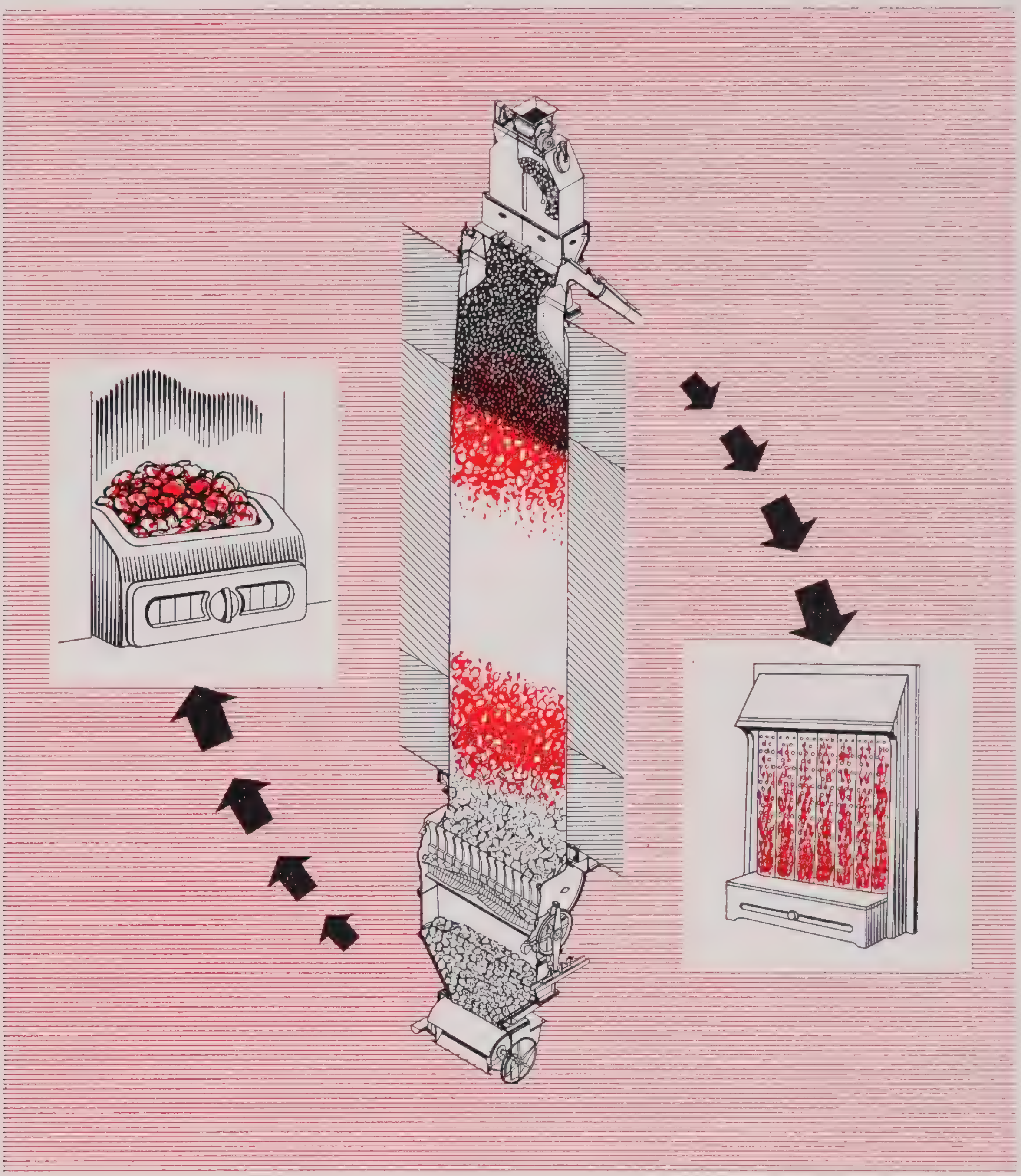
Sir George Elliston
Smoke Abatement in Metallurgical Furnaces
Fog and Smog
Smoke and the Law



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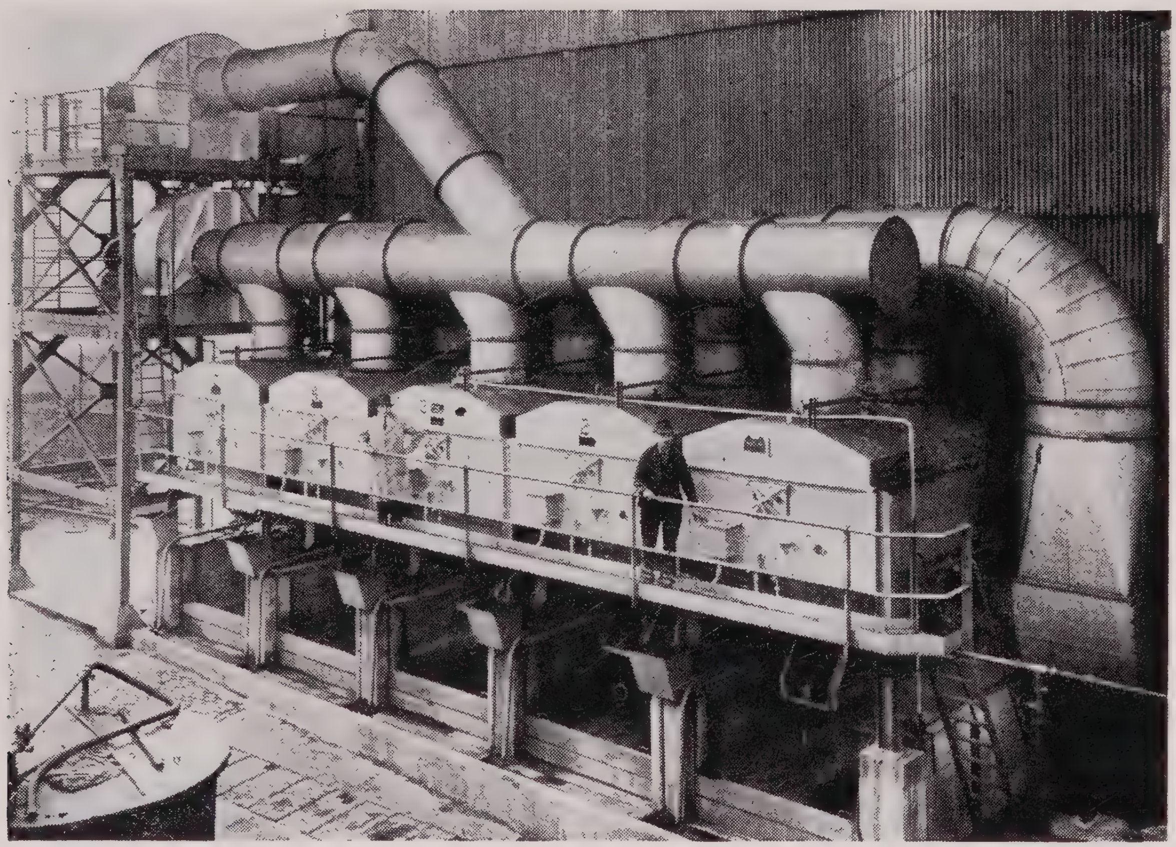

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Anybody concerned with promoting the cause of smoke abatement is invited to take full advantage of the free facilities offered by the Association.

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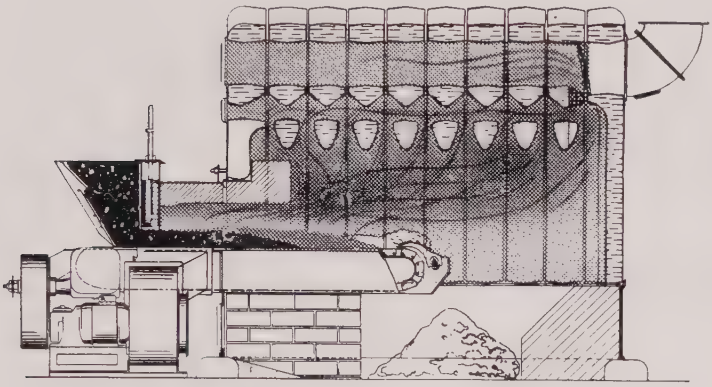

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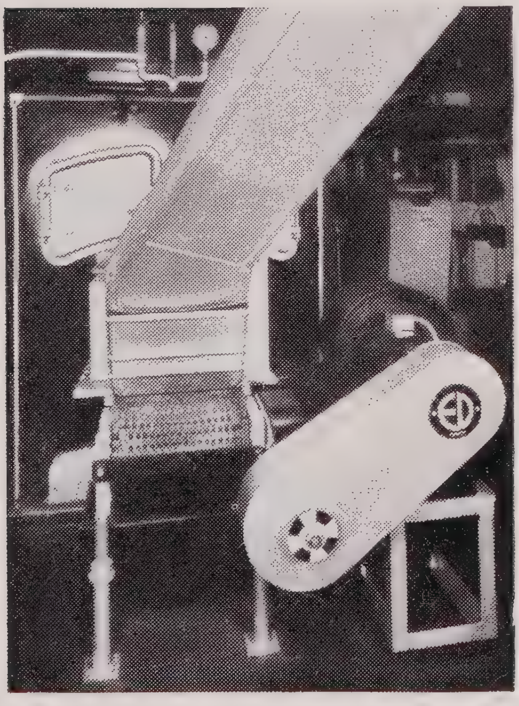

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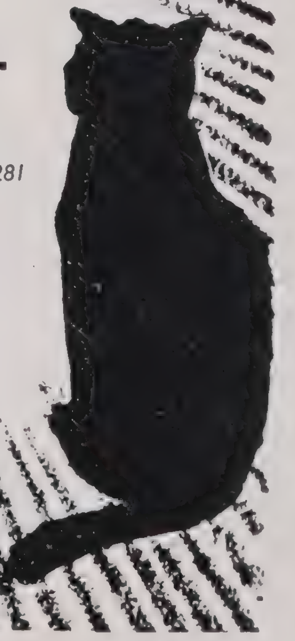

SMOKELESS AIR

Vol. XXIV. No. 89 Spring, 1954

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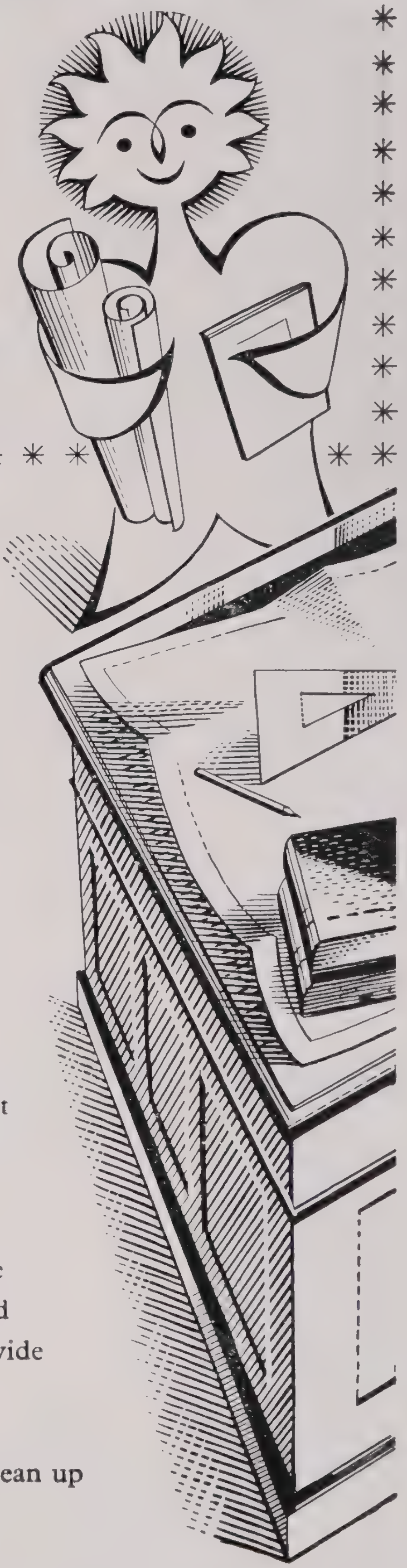
MR. THERM HAS A PLAN TO END THE FOG MENACE

Fog is a menace equal to the worst epidemic diseases. During the bad fog of the first week of December, last year, there was a greater jump in London's death rate than during the worst week of the terrible cholera epidemic of 1866. Fog's annual toll in death and disease, to say nothing of the heavy cost to trade and industry, makes action imperative.

Fog prevention begins with smoke prevention — and here Mr. Therm is ready to help. His twin fuels, gas and coke, never produce smoke or smut. But that doesn't prevent them from taking on the biggest — and smallest — assignments in industry and the home, and doing them efficiently and economically. New gas equipment is constantly taking its place in the latest industrial processes, while modern gas-ignited coke-burning open fires and stoves, with "background" heating by gas, provide the most satisfactory form of home heating. Mr. Therm urges the use of gas and coke as a practical measure to end the fog menace and clean up the air of our cities.

THE GAS COUNCIL · 1 GROSVENOR PLACE · LONDON · SW1



Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air

SMOKELESS AIR

Scarborough

The fine photograph above is of the cliff-top castle at Scarborough, where the Society's next conference will be held. It is a delightful town for the purpose, with an excellent hall for our meetings and plenty of good accommodation for the 400 members and delegates expected. The dates are Wednesday 22nd to Friday 24th September. Full details will be given in our next issue, but in the meantime we are pleased to announce that the Des Vœux Memorial Lecture will be by Sir Edward Salisbury, C.B.E., SEC.R.S., Director of the Royal Botanic Gardens, Kew, who will survey the many serious consequences of polluted air to plant life. On the economic side alone this is one of the most important items in the case against pollution and to discuss it in a Des Vœux Lecture there is no better, or more inspiring, authority than Sir Edward, as those who are fortunate enough to know, for instance, his book *The Living Garden*, will readily agree. Another highlight of the proceedings will be Sir Ernest Smith's first Presidential Address.

Beaver Committee

We understand from reliable sources (to use the time-honoured opening) that the members of the Committee consider themselves to be well-named, and that they are in fact being worked like beavers. The Interim Report is discussed and commented upon on another page, and it is now the next report to which we are looking forward. The Society has submitted a 10,000 word memorandum, which although it may seem lengthy, is in fact only a bare outline of what could be said about the policy we have urged should be adopted. The memorandum cannot yet be published, but it is hoped that it may be possible to include a reprint as a supplement to the next issue of this journal.

Bronchitis

The non-medical writer must tread warily in discussing the problem of bronchitis and its abnormal incidence in this country. But many of the facts are plain enough and abnormal seems the correct word to use, for in a table given in a recent article on "*Chronic Bronchitis in General Practice*," by John Fry, M.B., F.R.C.S., (*B.M.J.*, 190, 23 Jan. 1954) England and Wales head, by a long lead, a table showing death rates from this disease in different countries. Why, it must be asked, is the death rate here six times greater than it is in the Netherlands and Germany, nine times greater than Norway, thirty times higher than the U.S.A. and Finland, and sixty times more than in Denmark?

The factors responsible for these enormous differences may well be many, but when we see how, within our high national average, the incidence of the disease in the urban and industrial areas is so much greater than elsewhere, then it is not surprising that medical opinion is becoming more and more convinced that air pollution is an important, if not a major, agent. Dr. Fry in his article says that there is "no doubt that atmospheric pollution, as fog, produces serious effects in the chronic bronchitic. It is another matter, however, to deduce that chronic bronchitis is caused directly by atmospheric pollution, but there is strong evidence for this point of view."

This evidence is supported by figures contained in a recent report on *General Practitioners' Records* — an analysis of the clinical records of eight practices during the period April 1952 to March 1952. (General Register Office: Studies on Medical and Population Subjects No. 7; H.M.S.O., 1953, 8s. 6d.). The practices were varied and although from so limited a number the statistical inferences that can be drawn must also be limited, it is interesting to note that in discussing the diseases of the respiratory system the report states: "For the bronchitis group as a whole the rates were about twice the average in Practice No. 1 (Liverpool) and half the average or less in Practices No. 6, 7 and 8. (Burley (New Forest), Norwich and Hornchurch)."

Blowing the Gaff

When the survey of the sources of air pollution was carried out by the Society a few years ago it was found that laundries came pretty high in the list of offending industries, and the report commented, somewhat ironically, that "a large section of the industry seems to be engaged at a considerable cost to themselves in dispersing soot that they are prepared, at a price, to remove from our fabrics." This was felt, by the laundry interests, to be a most unkind remark, and obviously it was intended to prick.

Judge then our interest when we read the candid remarks of an executive of a well-known English firm of dry cleaners, Mr. Frank Fitzwilliams, as reported in an American laundry publication and reprinted in the British *Laundry Journal* of 15th January:

"Officers of England's National Federation of Dyers and Cleaners recently attended the Varsity International Conference of Drycleaners at Minneapolis and toured leading plants throughout the United States.

"'British cleaners enjoy several advantages over American cleaners,' states Fitzwilliams. 'Over there we burn the cheapest coal, and the heavy smog makes everything filthy. This is very good for our business.'

" ' Another thing,' he adds, ' English women wear gloves more frequently than American women. Milady grips the hand rail of a bus and her glove is covered with grime. Result: another half-crown job waiting for us.' "

So now we know.

Can this be True?

We may say hard words about smoke and smog, but we are not responsible for some of the odd things for which they are blamed. Such as, for example, the theory of an expert in diction and phonetics, Mr. Frank Jones, who in discussing the "Brummagem" accent with a newspaper reporter gave smog as one of the reasons for what he called this "monstrosity of speech." "Birmingham people," he is reported to have said, "who opened their mouths to make the correct sounds found themselves gulping in a mouthful of dirty air, so they developed a technique of opening their mouths only to the smallest possible slit and then straining the words through in a way which distorts them."

We quote this in some fear of repercussions from Birmingham, but hasten to point out that we make no comment beyond suggesting that it must have happened a long time ago, and adding that it was not a Birmingham, but a *London* paper (*Daily Mail*, 20th November, 1953) that published the story.

Our New Address

By the time this is published the Society will have removed to new offices at 30, Grosvenor Place, S.W.1, midway between Victoria Station and Hyde Park Corner. Accommodation at Chandos House has for a long time been insufficient and more room had to be secured for the further staff we hope before long to be able to engage and for the storage of stocks of publications and exhibition materials. The Society has been at Chandos House since 1937, when the move from Manchester was made. We now find ourselves among some of our distinguished members—the National Coal Board and the Electrical Association for Women on one side, and the Sanitary Inspectors' Association and the Gas Council on the other! We are sorry that, at the time of going to press, we are unable to give the new telephone number.

Staff

Changes in the designation of the Society's executive staff, recently approved by the Executive Council, should be recorded. There is no longer a General Secretary, and Mr. Arnold Marsh has been appointed to the new post of Director, while Mr. Victor R. Silver, previously Administrative Assistant, has been appointed Secretary. The Director will be responsible to the Executive Council for the general direction of the Society's affairs and especially for matters of policy and development, while the Secretary will be concerned mainly with the administration of the secretarial and business sides.

In the New Year's Honours List recognition of the value of the Society and its work was implied in the appointment of Mr. Marsh as an Officer of the Order of the British Empire.

Announcement by the Minister of Health

Smoke and fog
Mean smog.

Ask
For a smask.

(We're in a huddle
About the smuddle.)

J.B.B.

(Reproduced, with headline, by permission of the Proprietors of "Punch.")

THE BEAVER INTERIM REPORT

" No Material Improvement Unless . . ."

It was possible to make only brief reference in our last issue to the Interim Report of the Beaver Committee (Cmd. 9011; H.M.S.O., 1s. 6d., pp.31), which was published as we were going to press. The Report attempts little more than to appraise the air pollution problem and to make some recommendations for action that should be taken in a smog emergency. As the Committee produced the document within four months of its appointment even so limited a study will be recognized as good work by all who have any idea at all of the complexity of the problem. One of the most interesting, and significant, aspects of the publication of the Report was nevertheless the coolness and disappointment with which it was received by much of the Press; a matter that deserves examination.

First, however, the Report itself. Part One briefly outlines the problem and makes the recommendations that have been fairly well publicized and are outlined in the Minister's statement on another page, on precautions that should be taken to avoid the worst effects of a severe smog. In view of the suggestions sometimes made that it is the sulphur oxides that are the actively harmful agents in the pollution, and that therefore there is little point in preventing smoke unless these sulphur gases are removed, it is valuable that the Report should categorically state (para. 5) that " Both medical opinion and chemical investigation indicate that the deleterious effects of the oxides of sulphur are greatly enhanced by the presence of smoke particles and our conclusion therefore is that *the first objective should be to prevent the emission of coal smoke and oil smoke*, and of grit."

It is generally agreed that the prevention of smoke and grit is technically easier and can be achieved more quickly, than can the prevention of the sulphur oxides—although of course this should not be made an excuse for neglecting the sulphur problem, and later the Report says " we are well aware that the serious problem of sulphur oxides and other polluting agents will remain, and this is having our consideration."

Paragraph 8 sums up the industrial problem concisely and firmly: " The elimination of industrial smoke is intimately connected with the efficient use of fuel. With few, if any, exceptions, no industrial chimney need emit more than a light haze of smoke if the combustion arrangements are adequate and are properly operated. To achieve this will in many cases involve replacing or modifying existing equipment, and will involve capital expenditure; but it is completely possible.

Domestic Smoke

We like the Committee's early recognition of the key fact that " a first, immediate and stubborn obstacle to the reduction of smoke is the preference of the majority of people for traditional methods of heating. The need for education and training in these matters is urgent and vital."

It is pointed out (12) what where houses are closely packed a haze of smoke generally hangs over the district at all times except in windy weather, and that at its worst this turns into dangerous smog. " In any event," continues the Report, " it has the effect of reducing sunlight, inducing fogs, causing dirt and corrosion, and consequent deterioration of the whole neighbourhood."

The Report agrees that to solve the domestic problem it is necessary to replace existing grates by appliances suitable to solid smokeless fuels and to provide the fuels required. " The plain and inescapable fact is that there is nothing like enough smokeless fuel in the country for this purpose either now or in sight within the next few years." Reference is made to the Simon Committee's recommendations on solid smokeless fuels, made in 1946, on which it is said " little or nothing seems to have been done." However—and this is important—" Provision of smokeless fuel for the whole country on the scale indicated would inevitably be a long-term objective, but we believe it should be possible to provide within only a few years, sufficient smokeless fuel to supply all the worst areas."

Technical Survey

Part Two of the Report describes the main facts about the nature of air pollution, its main sources and amounts, its effects, the legislative measures, and the available means for prevention. Little in this section will be new to many readers of this journal, though it provides a most useful and up-to-date statement of the position for those not so well acquainted with the subject. For reference purposes the summary of this section is being included in a description of the Report in the Society's Year Book, 1954.

The tables of fuel usage and of the amounts of pollution emitted give a great deal of information in handy form, and we are illustrating the pollution figures in graphic form in the chart opposite. One form of pollution not included in the general table, to which attention is drawn, is the amount of carbon monoxide emitted during the combustion of coal, oil and petrol. No less than 24 million tons is the estimated annual emission from chimneys and the exhausts of vehicles. As this can be the most deadly contaminant of all it is interesting to compare its apparently minor rôle in the general problem with that played by the much smaller amounts of sulphur dioxide. Presumably it is because the latter is absorbed by moisture and then becomes associated with smoke particles, whereas the CO disperses (normally) as a free gas into the vastness of the atmosphere.

Sir Hugh Beaver
M.Inst.C.E., M.I.Chem.E.
Chairman of the Committee

The Conclusions

The Report ends in a way that should be quoted in full, and for emphasis we have ourselves put some statements in heavier type:

" This preliminary Report has outlined the main features of the problem of air pollution as it exists today. **The causes and remedies of pollution by smoke are known: the problem is one of practicability and economics, and of the education of the whole community.** *Complete* cure of both solid and gaseous pollution, if indeed it be ever attainable, is bound to take many years, but means of averting at least

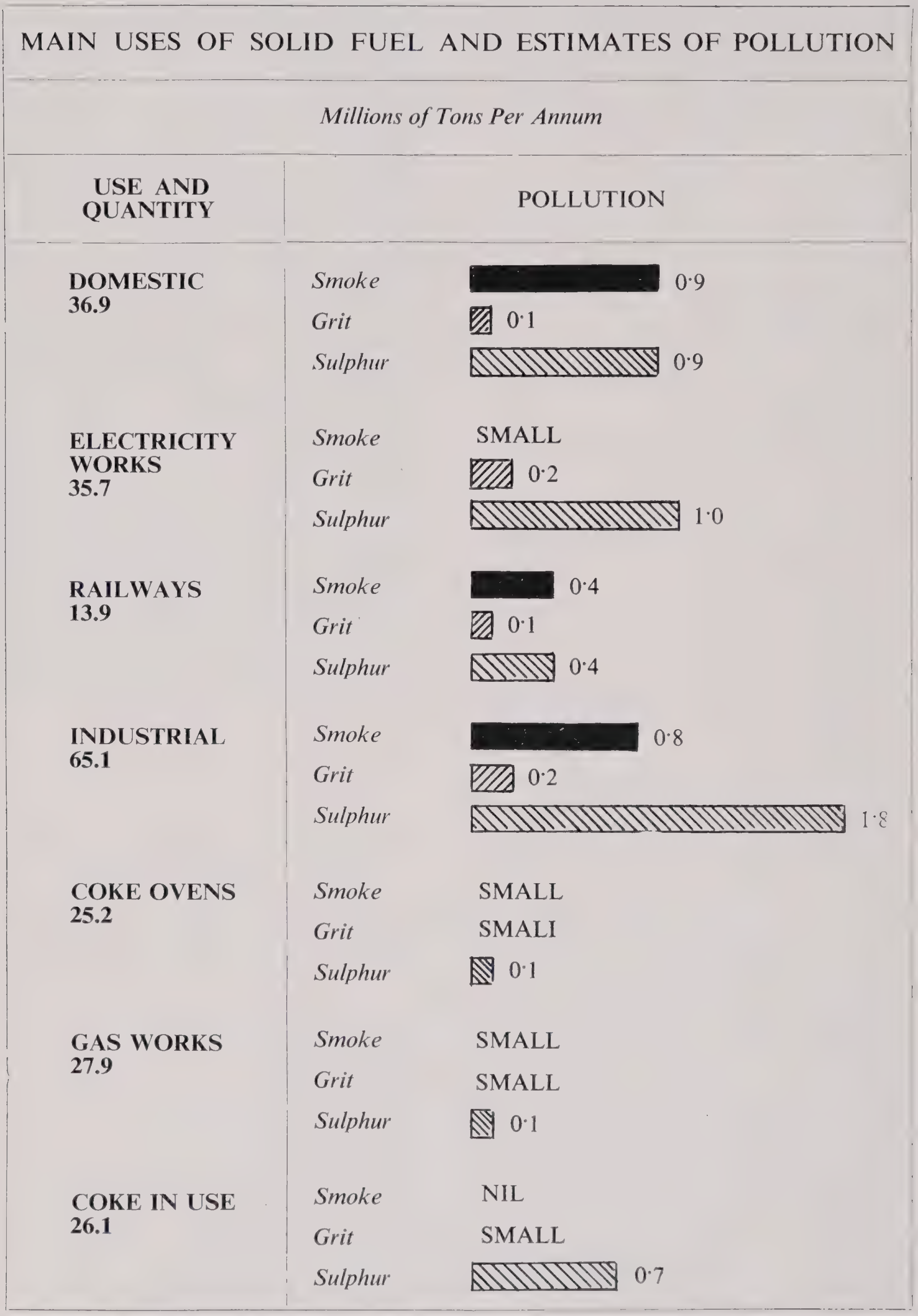


Chart based on a Table in the Beaver Interim Report.

the worst evils of *air pollution by smoke and grit* are within practicable reach. It is simply a question of balancing the cost and inconvenience of enforcing a more efficient and scientific use of our fuels against all the advantages to be obtained in health, convenience and economy from a clear atmosphere. This problem, with all that is involved in a real attack on the menace of air pollution, is one which must be faced. We now propose to embark upon the detailed study of the practical difficulties which we have indicated in this interim report. **But we feel bound to point out that such work will be merely of academic interest and can lead to no material improvement unless there is general acceptance of the fact that the cure will require heavy expenditure and full co-operation of all persons and all interests.**"

The last sentence is perhaps the most important in the whole of the Report. There is indeed a danger that, as in the case of earlier Government Reports on the subject, the work will remain merely of academic interest. In the Memorandum the Society is submitting to the Beaver Committee this is being stressed, though in different words, and the problem—which has always been the Society's problem and is now the Beaver Committee's as well—is how to bring about the acceptance and co-operation that is necessary if the task is to succeed.

The fact that the case is now generally accepted by the informed and influential minority of people is not enough: it must be given a higher priority in the affairs of the nation. And for that it must be more widely understood and demanded by the public generally.

The lack of enthusiasm in the Press reception of the Report, mentioned above, which was probably a fair reflection of popular public opinion, is an excellent example of the difficulties to be overcome. There had been a scare; an ancient but shadowy evil was found, quite a time after it had struck, to have real substance; in due course a Government Committee had been appointed; then came apprehension about the possibility of another lethal visitation. Something, it was widely felt, must be done. For the first time in its history an aura of emotion could be discerned around the words smog and smoke. Any report short of a fairy story would have been disappointing to the uninformed.

Those newspapers that have in the past recognized the smoke problem for what it is, and are reasonably knowledgeable, were on the whole fair and moderate in their comment on the Report, and it was the papers which had given little or no attention to the problem and hardly knew the first thing about it that were most critical and even downright silly.

The moral is plain: the subject is too big for quick, unthinking understanding or for easy simplification. Apart from the occasional smog even the effects are not easily observed and their presence only too readily becomes a familiar, unnoticed part of urban life. Our smoky air is simply a bad habit, and it is always difficult to make people admit their bad habits. Parallel with the technical progress that is necessary, and both stimulating it and being stimulated by it, there must be educational propaganda on a much bigger scale than has hitherto been possible. And one of the first jobs of this campaign will be, we hope, to "put across" the final report of the Beaver Committee, and to make certain that it does not become a document of mere academic interest.

The Birmingham Mail records an "anti-smog campaign" launched at Smethwick, in which hundreds of the leaflet "Facts About Smoke" have been put inside library books and will be distributed by the central library. This leaflet is published by the Society and quantities may be purchased by any local authority.

Statement by the Minister of Housing and Local Government to the House of Commons, 2nd December, 1953

The interim report of the Committee on Air Pollution is being published to-day, and the Government have given it careful consideration. As the Committee points out, the problem of air pollution, and of smoke in particular, has been the subject of study and research over a long period.

Among the measures taken in recent years to reduce smoke, are the development of domestic heating appliances, including improved types of open fires, which will burn smokeless fuel efficiently and well. These appliances have been installed in all local authority houses built since 1948. For this winter, the domestic allocation of coke has been increased from 1½ to 2 tons. The Ministry of Fuel and Power provide a fuel efficiency advisory service to industry, as well as special loan facilities to industry for the installation of fuel saving equipment. Statutory powers to establish " smokeless zones " have been conferred on a number of local authorities.

As the Committee emphasize, it must be accepted that the complete cure of pollution, if indeed it ever be attainable, is bound to take many years. The Committee are now embarking on a detailed examination of the many practical difficulties involved in further measures.

The " smog " which covered Greater London for five days, 5th to 9th December, 1952, was of exceptional density and duration. Nevertheless, similar conditions may recur in London or in other towns. The Committee have considered what precautions might be taken to avoid during the coming winters the worst effects of " smog."

On 17th November, before the report was submitted, doctors were authorised to prescribe masks under the National Health Service for patients suffering from heart or lung disease living or working in an area where smoke-polluted fog is likely to occur.

Following the Committee's recommendations, the Government have already arranged for the Meteorological Office to issue through the usual channels warnings when serious fog is expected to prevail for at least 24 hours in areas of normally high pollution. These fog warnings will be accompanied by advice to the public about the ways in which they can help to reduce smog and its ill effects.

The Committee's report stresses the fact that the largest single producer of smoke is the domestic consumer. Everyone therefore has both a duty and an opportunity to help. Householders in large towns who are dependent on solid fuel and who normally burn coal should, wherever possible, lay in a stock of, say, one hundredweight of coke or other smokeless fuel for use in periods of persistent fog. Even a mixture of coke and coal will greatly reduce smoke. Stocks of coke at gasworks are high and supplies are readily available for the reserve hundredweight to be kept in readiness by those who normally burn coal. Those already burning coke will benefit from the increase of half-a-ton in the coke allocation (from 1½ to 2 tons) recently announced.

When persistent fog is forecast:—

(1) Coal fires should not be banked up at night.

(2) Those who can use smokeless fuels should confine themselves to those fuels during periods of fog.

(3) Rubbish should not be burnt nor bonfires lit while the fog lasts.

(4) Elderly people and those suffering from chronic heart or lung conditions might be helped by

wearing a mask or scarf wrapped round the mouth and nose if they have to go out in the fog.

(5) The general public should refrain from bringing motor vehicles into densely-populated areas.

Smoke control measures in industry, shops, offices and hotels, etc., should be brought up to peak efficiency at once and checked at frequent intervals throughout the winter. Special efforts should be made to prevent smoke when stoking. Much of the smoke from factory furnaces can be prevented and it is the responsibility of managements, particularly in times of fog, to see that smoke is kept to the minimum.

Managers of industrial plants, hospitals, offices and other establishments should keep a special check to ensure that dark smoke is not emitted from their chimneys either by day or night and particularly in the early morning. This check can best be made by the installation of a simple smoke-density indicator. The report contains drawings of simple devices which can be made up cheaply by most small works. Copies of these drawings can be obtained from the Ministry of Housing and Local Government and from the Department of Health for Scotland.

The Fuel Engineers of the Ministry of Fuel and Power are working in co-operation with the Inspectors of the local authorities in a special drive to bring home to managements the importance of fuel efficiency in the interests of smoke abatement. Full use should be made of these services by any business in doubt as to its proper course.

All these measures together, if conscientiously carried through, will help to alleviate and reduce the injury which might be done by another series of " smogs " this winter.

The Government are studying further steps which might be taken to ensure application of these measures and make them more effective, while awaiting the next report of the Beaver Committee.

More Smoke-Free Travel

Diesel electric locomotives were used experimentally for a week recently to haul the Golden Arrow and Night Ferry boat trains between Victoria Station and Dover

" *Times* " *photograph.*

SIR GEORGE ELLISTON

We regret to have to record the death, in London on 21st February, of Sir George Elliston, at the age of 78. Sir George was President of the Society from 1945 to 1948: the first President to be elected under the new constitution. Smoke abatement was one of Sir George's later interests and he brought to it the qualities that had brought him success and esteem in his other undertakings and interests, and which gained for him the admiration and affection of all with whom he came into contact.

George Sampson Elliston, M.C., M.A.Camb., D.L., J.P., was a Suffolk man who during the first world war served in the R.A.M.C. with the rank of captain, and was later attached to the 1st Cavalry Division, B.E.F. He was awarded the Military Cross. A barrister at Lincoln's Inn, he founded the weekly journal *The Medical Officer* in 1908, and remained in the editorial chair until his death. After the war in 1918 he took the post of part-time secretary of the Society of Medical Officers of Health. In this and other public health service he worked for many years in a way that has gained for him the tribute in the *Lancet* that " There are few laymen who have done more for the advancement of public health in this country and none did more for doctors in the public health service."

Sir George was for 25 years a member of the corporation of the City of London, and was chief commoner in 1953. In 1931 he was elected a Conservative M.P. for Blackburn and retained his seat until he retired from Parliament in 1945. Among other activities he was chairman of the committee of management of the London School of Hygiene and Tropical Management and chairman of the council of the Cremation Society.

It was through the interest of *The Medical Officer* in smoke abatement, and editorials that were so encouraging to the National Smoke Abatement Society, that Sir George revealed his deep interest in smoke prevention, and his Presidency, during the first post-war years, when the Society was developing rapidly, but in the face of many difficulties, was inestimably valuable. Not only was his wise and friendly personality exactly what was needed at our meetings and conferences, but behind the scenes his guidance and kindliness were of unfailing help.

Although during the last few years Sir George had not been in the best of health his interest in smoke prevention remained as great as ever, and with his death the Society has lost one of its best friends.

The February issue of *The Sanitarian* the journal of the Sanitary Inspectors' Association, is a special Atmospheric Pollution number, on which the Association should be congratulated. It is full of useful and interesting articles and reports on air pollution matters, and includes a reprint of the N.S.A.S. *Guide to Publications*— publicity which is valued by the Society and has resulted in a number of orders for literature being received.

The War Against Smoke

Some Early Campaigns*

By Stanley Hyland

Michael Angelo Taylor, the man who put lamps and paving stones in the streets of London and abolished the pillory from our market-places, moved in the House of Commons on 8th June, 1819: " That a Select Committee be appointed to inquire how far it may be practicable to compel persons using Steam Engines to erect them in a manner less prejudicial to Public Health and Public Comfort."

Steam engines (he said) are now so numerous in many places that the smoke that issues from them clouds the atmosphere and endangers the lives of his Majesty's liege subjects. To prevent this, I want the Legislature to compel these steam engines to consume their own smoke.

Taylor got his Select Committee without a division.

Evidence rolled in. Plans, models, and what we now call " artists' impressions " (heavily engraved on steel) were handed in to the Committee. Inventors, doctors, architects, ambitious bricklayers, and other " experts " (many of them very obviously bogus) explained how easy it was to eliminate what Taylor, the chairman, called " these violent tornadoes of Smoke." In the next year, Taylor's Committee reported twice to the House. They " confidently hoped that the nuisance so universally and so justly complained of may at least be considerably diminished, if not altogether removed." They gave first prize to Josiah Parkes, a worsted manufacturer in Warwick, and highly commended a Mr. John Wakefield on whose skill in the abatement of smoke thirteen millowners in Manchester had written a testimonial.

A Model Brewery

While Taylor's Committee was sitting, three East London parishes petitioned the Commons to do something about " the large columns of Smoke issuing from the very extensive Breweries." The petition was referred to Taylor's Committee. The complaint might be made against some breweries but not, said the Committee, against Messrs Barclay Perkins's. The whole Committee, with a good number of other members and a weighting of Peers (a considerable party in size and authority), spent a day out there. There was no smoke to be seen—Josiah Parkes had been called in. The problem was solved. All that was needed was an Act of Parliament, and Josiah Parkes.

On May 18th, 1821, Taylor, Henry Brougham, and Thomas Denman were given leave to introduce their bill. It went thorough both Houses in six weeks, " An Act for giving greater facility in the Prosecution and Abatement of nuisances arising from Furnaces used in the working of Steam Engines." It was the first of a long line of smoke abatement acts—and it was dead before it even left the House of Lords. By way of preamble it reaffirmed the right which anyone had (and still has) to bring an action at common law against the owner of a chimney which is making a nuisance of itself. But such an action is, and was, both chancy and costly, and Taylor's Act broke new ground only in giving the courts the power to award costs to the prosecutor.

Twenty years later the Commons had to take up the problem again. In 1842 the Lord Mayor of London petitioned the House of Lords to do something about smoke. Close behind him came the Mayor and Corporation of Leicester—they petitioned the Commons—and the hunt was on again. The man mainly responsible for the activity was William Alexander Mackinnon, the member for Lymington. In the three parliamentary sessions from 1843 to 1846 Mackinnon inspired and directed two Select Committees on Smoke; he introduced three bills, or the same one three times, and forced the Government to set up a two-man Commission of Enquiry. The two men were Sir Henry Thomas de la Beche and Dr. Lyon Playfair. The bill was lost as often as it was put up. The Select Committee took so much evidence and built up such a picture of complexity that neither the Government nor Parliament really dared face the issue properly—" the issue of opaque smoke," as the experts called it. At least one witness knew the value of what he called " that ingenious instrument called the Respirator." If you wear it, he said, in a fog anywhere near a smoky town, and then take it home and wash it, the colour of the water will do more than anything else to convince you that the smuts, " the blacks," as he called them, ought to be prevented if at all possible.

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*Reprinted from the " Manchester Guardian " by kind permission.

The Open Grate

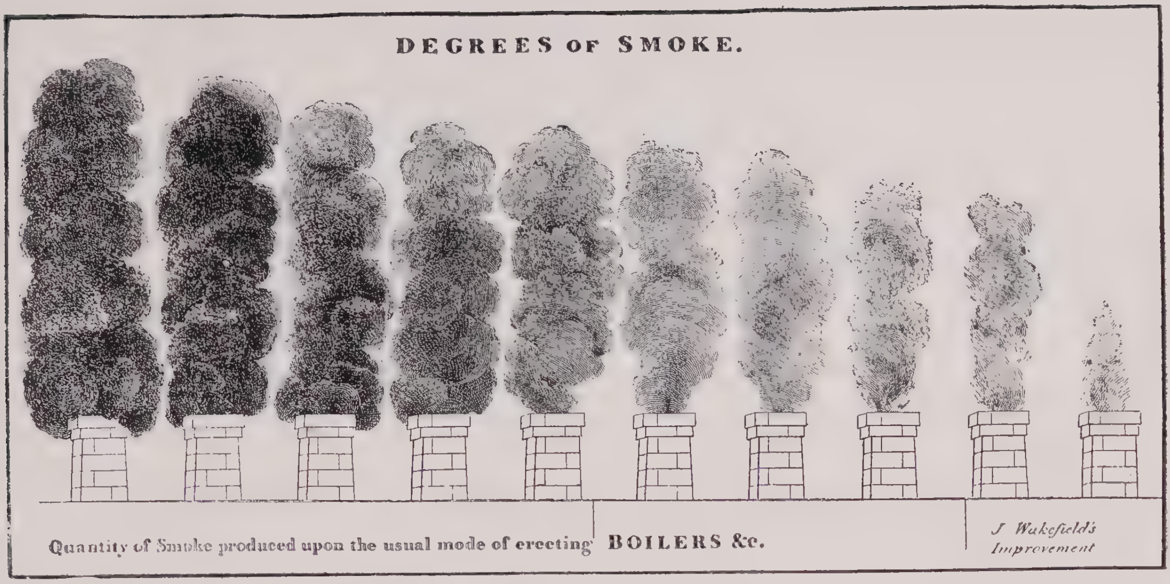
Dr. Andrew Ure, F.R.S., who gave evidence, spent much time justifying the Englishman's open fires, smoke or no smoke:

> I am sure (he said) that anyone who has ever experienced the effects of the stove-heated rooms of Russia, Sweden, or Germany would deprecate their imitation in this country. The sallow and withered complexions, their headaches, and dyspeptic ailments are well known to observant English travellers who perpetually contrast the foul, stagnant air respired in their apartments with the fresh, invigorating atmosphere of an English parlour as heated by the open cheerful grate.

Dr. Ure's championship of the open grate was endorsed by every one of the Select Committees' reports: each one in turn said nothing ought to be done, or needed to be done, about smoke from private houses. This seems to have been the only observation that went unattacked.

The idea of legislation to force millowners to spend money on new equipment was violently opposed both before the Select Committees and in the House itself every time Mackinnon's bill came up. John Bright called it " peddling legislation " (" peddling " is the way it is printed in Hansard), and at least one member somehow managed to bring the Anti-Corn Law League into the debate to damn the bill. The Government thought it was premature, and the petitions presented seemed to support the Government: seven for the bill (all from inhabitants of the larger boroughs), eleven against it (all from millowners in the same boroughs). The sudden fierce activity (mostly due to Mackinnon) came to an end when de la Beche and Playfair made their report to the Home Secretary. They went no farther than their brief had urged them to go. They admitted (and they were both scientists) that the expert witnesses before the Select Committees has said all that could be said about the technique of smoke abatement. They confined themselves to the law against it; and they found that the law needed changing.

A number of northern towns (they named Manchester, Derby, Leeds and Bradford) had got powers of abatement into local acts, but they did not recommend an extension of this practice. In principle the local powers were good; in point of law and fact they were bad. Most of them were based on the Derby Improvement Act; and that had been so badly drafted that the courts had decided that no one could sue a millowner for making too much smoke until his chimney had been smoking day in, day out, night in, night out, for a week. And then you could get a fine of forty shillings


DEGREES OF SMOKE.
Quantity of Smoke produced upon the usual mode of erecting BOILERS &c.
J Wakefield's Improvement

The " shade card " submitted by John Wakefield to the Select Committee of the House of Commons appointed in 1819 *" to inquire how far it may be practicable to compel Persons using STEAM ENGINES and FURNACES in their different Works, to erect them in a manner less prejudicial to Public health and Public comfort." The two blameless chimneys on the right belong to furnaces incorporating Wakefield's improvement, which had been tried out in factories in Manchester.*

out of him—provided you could prove by constant observation that his chimney had been an unceasing nuisance for a week. Birmingham had gone to the other extreme: forty shillings became fifty pounds. Magistrates hesitated to impose a fine like that. " And," said the commissioners, " the magistrates themselves are frequently the principal smoke-makers."

The campaigners against smoke, however, were making some ground. When the Railway Clauses Consolidation Act was passed in 1845, a clause went in to compel railway engines to eat their own smoke; and a clause crept into the Town Improvement Clauses Act in 1847 giving local authorities power to see that mill chimneys were as well built as was possible. This of course, meant little, but it meant just a little more than nothing. It cleared the way for the Act of 1853, the " Act to abate the Nuisance arising from the smoke of Furnaces in the Metropolis and from Steam Vessels above London Bridge."

Furnaces (said that Act) in any Mill, Factory, Printing House, Dyehouse, Ironfoundry, Glasshouse, Distillery, Bakehouse, Sugar Refinery, Brewhouse Gasworks, Waterworks or other Buildings used for the purpose of Trade or Manufacture shall be constructed or altered so as to consume or burn their smoke.

" Provided always," it went on, " that the words ' consume or burn their smoke ' shall not be held in all cases to mean ' consume or burn all their smoke.' " That was Palmerston's Act, the first true Act for the abatement of smoke, and it went on to the statute book a century ago.

A year after it became law, Palmerston ordered the General Board of Health to make a survey of smoke-burning apparatus, and the House of Commons asked for details of prosecutions under the Act. It showed that 186 people had been sued and 152 had been convicted. Fines amounted to £614 10s. The cost of this investigation was £898 12s. The survey from the General Board of Health covered much the same ground as the Select Committees ten years earlier. But two new ideas emerged:

Great facility would be afforded by the appointment of officers (specially qualified and not connected with any patentee or manufacturer of boilers

(Concluded on page 128)

REPORT ON DISTRICT HEATING

Post-War Building Studies, Numbers 31 and 32 by the Heating and Ventilation (Reconstruction) Committee of the Building Research Board of the Department of Scientific and Industrial Research. (H.M.S.O. 1953, No. 31 Parts I-V 7s. 6d. No. 32 Part IV 10s. 6d.

The first volume reviews the existing schemes for the supply of heat and hot water to a number of buildings in a locality from a central station by steam or hot water.

Experience in Great Britain is limited but the report summarizes also experience abroad, mainly in the U.S.A. and the U.S.S.R., while the second volume provides a thermal-electric (basic) scheme for a town having a population of 250,000 covering an area of 25 square miles. The costs are estimated on the basis of prices ruling for the last year of stable prices, 1937, which year provided also a range of temperatures very near to the average.

District heating schemes were established in Dundee in 1920 and 1922, background heating and hot water being supplied from central boiler houses at a cost to two bedroom flats in 1942 of 3/3d a week and in 1947 of 5/6d a week. In 1911 a thermal-electric scheme was operated from the Dickinson Street Power Station, Manchester, but this station is not now used as a generating station although it continues to function as a station for district heating. A large steam system linked with power production has been provided by Imperial Chemical Industries at Billingham-on-Tees.

The rising cost of fuel and increasing public consciousness of the cost to the nation of smoke, largely attributable to domestic fires, and the opportunities presented by establishment of new towns, has directed attention to the possibilities of district heating, and experience acquired abroad has been examined.

The first thermal-electric scheme in the U.S.A. was set up in 1877 in which turbine exhaust steam was distributed to a central urban area. A new thermal-electric scheme is being developed by the New York Steam Corporation from which it is anticipated to achieve large fuel economies.

In the U.S.S.R. development of thermal-electric district heating, distributing both by steam and hot water has been rapid, and in 1939 106 thermal-electric plants were operating and it seems to be the policy to extend the use of back-pressure or extraction turbines for district heating.

Considerable development has taken place in Germany while Zurich provides a scheme of exceptional interest in its thermal-electric power production and district heating system incorporating a heat pump.

The report draws attention to the saving of fuel that would result from the recovery of a considerable fraction of the heat dissipated in the cooling water of condensing generating turbine sets, but recalls that to provide heat at a temperature suitable for district heating and maintain the station output would entail the provision of increased boiler and generating plant.

The report deals extensively with district heating schemes abroad using both hot water and steam as the distributing media, systems of distributing mains in tunnels and conduits and the heat losses incurred in many systems. A useful table of the cost per therm in terms applicable to different years in schemes operating in Great Britain is included from which it seems that thermal-electric schemes would provide heat at considerably lower cost than that provided by the pure thermal scheme.

Conclusions

In summarizing information gathered from available sources the report concludes that the development of district heating is desirable in the interest of the efficient use of fuel, the improvement in living conditions by eliminating dirt and labour, and the prevention of atmospheric pollution. Although temperatures in Great Britain do not vary to the extent common in many countries, the proportion of the year when some heating is necessary is relatively high. Although much experience is to be gained from abroad, this requires careful interpretation in relation to technical and commercial practices existing in these countries. Large plants could operate under more favourable conditions than small plants and moreover they would be capable of operation with low grade fuel. The conversion of existing generating stations to thermal-electric operation is generally impracticable as it would involve a considerable sacrifice of electricity production, and moreover the installation of a district heating scheme in fully developed urban areas offers many difficulties. The best conditions are offered by newly developed areas or by areas due for complete redevelopment. In thermal-electric schemes the balancing of the electricity and heating loads would require to be effected by the use of the National Grid and possibly by thermal storage. Metering of heat to small consumers presents a problem which in the event of cheap metering devices not being available might be solved by design of consumers' apparatus in conjunction with control of flow in the mains.

The Report approaches the basic thermal-electric scheme by way of a preliminary scheme for an area of 5 square miles involving a thermal-electric scheme and a straight thermal scheme in which the electricity generation was limited to that required to serve the auxiliaries of the plant. The two schemes were, on a costing basis set out in the report, to be capable of supplying heat to consumers at 5.1d and 6.4d per therm respectively.

The basic scheme is designed for a town of 250,000 inhabitants of whom 150,000 are consumers. The area covered is 25 square miles of which the developed area is 5,100 acres. The collective demand is 16.288 therms a house and the heat load factor 29.3 per cent and the scheme is designed to give to the consumer a service at a cost not greater than that of fuel, with a service in advance of that commonly provided, the need for heat metering being avoided by control of the central plant. The cost works out at 4.62d per therm.

With certain assumptions it is estimated that the annual fuel consumption for space heating and hot water supply would be 145,000 tons in the basic scheme compared with 277,000 tons under present conditions, consumers receiving 32 per cent more heat.

The Report constitutes a comprehensive compendium of the factors involved and of the data of plant requirements and costs that should serve as an effective yardstick for the design of a thermal-electric plant to meet the requirements of any community.—*A.J.C.*

District Heating —By A. E. Margolis

A comprehensive technical paper by Mr. Margolis was read at the British Association meeting in Liverpool last September, and has been published in full in *Engineering* (October 9th and 16th, 1953). Space allows us only to quote from the author's conclusions on the future of heat-electric generation. He said:

The problem by itself is scientifically sound, and the great potentialities of co-ordinated heat-electric generation for the economy of this country cannot be disputed. At an average domestic consumption of 600 therms annually some 75,000 × 10^6 kWh might be generated in the future in heat-electric stations for residential purposes only, which is, say, 30 per cent more than the total electricity supply demand under present conditions. Looking ahead we can visualize a time when no burning of coal inside towns will be required as outlined in the previously mentioned contribution of the author to the 1942 conference: " Improvement of Climatic and Living Conditions by Public Heat Supply."

This development will involve, however, a very great amount of investigating work, problems of reorganization and of co-ordinated planning and a considerable capital expenditure. The greatest part of the capital required is not for district heating but for central heating installations not already provided, which is due to the neglect of scientific development in the past.

After the 1914-18 war the majority of new dwellings in Holland, Switzerland, and Germany were equipped with central heating but in this country central heating for dwellings is even today considered as a luxury and the new towns are being built with all kinds of coal fires. The general trend towards improved heating installations cannot, however, be stopped and the additional cost of central heating will finally have to be debited to the cost of houses. We live in a time of continuous evolution and new dwellings are built for a lifetime of at least 60 years. It is really amazing that planners do not look ahead and plan to meet the steady growing requirements for comfort, health and beauty for the generations to come.

What we need is to take quick action and to endeavour to adapt our heating installations to the already existing pattern of scientific development of heat-electric generation of the Pimlico district heating scheme for the City of Westminster. An annual saving of 20 million tons of coal should be our aim which is only a modest figure when compared with the present great waste of coal.

Meanwhile, most of the damaged buildings in Hamburg have been restored and the heat output of the stations, including the new heat-electric station at Hamburg, has increased in the last year to 34,000,000 therms. The great popularity of district heating in Hamburg is demonstrated by the fact that last year the total new load, on the hot water system only, amounted to 80,000,000 B.Th.U. per hour, which is approximately equal to the total load on the Pimlico undertaking when fully developed. A notable fact is that the costs of the connections and of all apparatus required in the buildings are now being met by the consumers. It may also be mentioned that a very large extension to the district heating system of Charlottenburg was commenced in 1952. Three back-pressure pass-out turbo generating sets, each of 50 MW, are to be installed. The delivery of the first set is scheduled for the spring of 1955.

THE WAR AGAINST SMOKE (*concluded*)

and furnaces) to superintend the police officer.

That was the first idea; the other was that these officers in London should keep constant watch—some on top of the Monument, others on top of the Victoria Tower in the Palace of Westminster.

The British Electricity Authority has prepared a Memorandum (GO/0326/ET) on Dust Sampling Equipment, which describes an apparatus recommended for this purpose and gives a detailed account of the method of carrying out tests. The apparatus is of a two-stage type, the first stage consisting of a cyclone collector and the second of a glass wool or slag wool filter. The Memorandum has not been published for sale but particulars may be obtained from the Authority by those technically interested.

Smoke Abatement in Metallurgical Furnaces

A Report by Dr. R. J. Sarjant,
of the work carried out in the Department of
Fuel Technology, University of Sheffield, during 1952-53.

This research has been concerned with the problem of smoke emission from low temperature metallurgical furnaces. A survey of existing practice was first undertaken to determine how far the causes were due (i) merely to economic factors, such as could be met by improvement or replacement of obsolete plant on well known lines, or (ii) to sociological factors, to be overcome by better application of existing knowledge, or by strengthening of the law in regard to smoke abatement or by other appropriate means involving the application of human incentives, or (iii) to the character of any technical problems still unsolved.

It was abundantly evident that there existed both economic and sociological problems, to which obvious remedies could be applied, but these involved political questions which were outside the field of inquiry.

There was revealed an important technical problem possessing critical features relating to the heating up of certain types of special steel upon which, with many other types, the far-famed reputation of Sheffield for quality has depended. Further, there was presented a general problem relating to all metallurgical furnaces heated up from cold and firing raw coal. It had regard to the chilling effect of the furnace charge and structure on the combustion of the hydrocarbon constituents of the flame. This chilling inevitably resulted in the formation of smoke if the hot surface of the furnace structure was below a temperature of 750°C. In regard to the heating of the critical types of steel a comprehensive study was undertaken into the effect of various types of furnace atmosphere, both with and without smoke, on the quality of the steel heated. With that investigation completed and a working knowledge established of the atmospheres required, the third stage was to investigate the conditions under which coal-firing appliances could be used, and how new types could be designed to give the required types of atmospheres in the plant in question.

An accepted alternative to coal-firing is the use of town gas, but even with the use of town gas technical problems arise in regard to the safe heating of the difficult steels.

Furnace Survey

A very wide and detailed survey was undertaken in which the manufacturers were one and all most helpful. The use of coal-fired furnaces extends to practically all heating processes, although both gas and electricity are favoured for certain specialized operations in the production of sheet, wire and file steels.

The use of smoky atmospheres in such coal-fired furnaces was to prevent " burning " of the steel, and to improve the temperature distribution in the furnace chamber. With the " burning " there occurs oxidation which results in undesirable scaling—" decarburization which arises with the removal of carbon from the grain boundaries of the steel." This may cause, at a machined surface in subsequent service, sources of weakness, which may give rise to failure by cracking. Again the physical character of the scale produced may be a matter of much importance in the subsequent treatment of the steel. A scale may be preferred that is readily removed either in forming or on pickling. Thin, adherent scales may be less suitable than thicker loose ones.

Low temperature furnaces employing the hand-firing of coal, e.g. rod and bar annealing at 750°-850°C. gave rise to heavy smoke emissions. This was due to the low rate of fuel consumption per unit area of grate, and hence low fuel bed temperatures. The smoke problem in such furnaces was reduced by the use of mechanical stokers of the underfeed type, which could operate with a light smoke haze at low combustion rates.

With regard to the scale forming propensities of the different fuels used, increasing formation of scale occurred in the order, towns' gas, coal, coke; adherence or stickiness of the scale increasing in the order, hand-fired coal, underfeed stoker, towns' gas. Thus towns' gas produced less but a more adherent scale. Particular steels rather difficult to process were,—nickel-chromium tool steels which gave a sticky scale; 4-6 per cent nickel steels giving a very adherent scale, especially under reducing or non-oxidizing conditions, and silico-manganese spring steels, very susceptible to decarburization in " active " atmospheres. What could be regarded as an " active " atmosphere was the subject of a detailed technical study, having some aspects of complexity.

The survey showed that in order to reduce smoke emission in coal-fired furnaces more knowledge was required about the optimum conditions of furnace atmosphere required for the heat treatment of the different types of steels. Attention was also required to be given to the improvement in design of firing mechanisms and combustion chambers.

The Heating of Steels

Study of industrial furnaces in operation had shown that atmospheric conditions varied widely under practical conditions, and that in order to make any progressive study the practical conditions of industry had to be simulated in the laboratory. Such laboratory studies were carried out on a range of critical steels, using a simulated atmosphere that resembled in every respect the practical one, but had the advantage of being strictly controllable. Many valuable technical facts have been thereby established from which the following may be cited, as typical :

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O.B.E., D.Sc.

(i) For atmospheres ranging from 8 per cent oxygen to 8 per cent combustibles the scale formed in towns' gas atmospheres is less than that formed in the corresponding atmosphere produced from the combustion of coal. The sulphur present in the coal has a critical influence at certain concentrations of oxygen or combustible.

(ii) Air deficient atmospheres with coal-firing produced minimum scaling. Similarly minimum scaling with towns' gas occurred with air deficient atmospheres containing 5 per cent of combustibles (as CO and H_2), or more.

(iii) The presence of sulphur dioxide

caused a rapid increase in the rate of scaling, indeed more than in atmospheres containing excess air. Using coal, and air deficient atmospheres the enhanced scaling due to sulphur dioxide could be reduced by the presence of a small excess of free oxygen, 0.5 per cent. The small excess of oxygen neutralized the effect of the sulphur dioxide at varying air deficiencies.

(iv) In air deficient atmospheres, using coal, the scale contained active sulphur constituents which promoted scale adherence; these could also be diminished by the use of slight free oxygen concentrations.

(v) The presence of small amounts of alloying elements, such as chromium, tungsten and nickel, caused adherent scales in sulphur-containing atmospheres. Special alloy steels varied widely in their response to the different types of atmosphere, both as regards scaling, decarburization and resistance to sulphur attack.

(vi) Smoke *per se* had no appreciable influence. It merely happened to be a natural constituent of the air deficient atmospheres. A desirable industrial atmosphere was, for coal, one with the smoke completely burnt, and a small oxcess of oxygen.

Formation and Combustion of Smoke

An apparauts for measuring smoke, called a thermal precipitator, was used throughout these experiments. It enabled the following facts to be established:—

(i) That the distillates from a fuel bed could not be burned below a temperature of 700°C; above 750°C the combustion of the tarry matter was solely a function of the air supply and was independent of temperature.

(ii) Carbon smoke particles very difficult to burn were produced by " cracking " of unburnt tarry distillates at temperatures between 860°C and 1,080°C.

(iii) It was found possible, using theoretical air requirements, to achieve complete combustion of the volatile matter arising from the fuel bed at all temperatures greater than 700°C provided that (a) no carbon smoke was formed in the fuel bed, and (b) that good mixing of the air and distillation vapours took place before the vapours were subjected to a high temperature or the ensuing flame was cooled.

Experimental Mechanical Stoker and Combustion Chamber

This combination of a novel type of mechanical stoker and combustion chamber, designed and erected in the Department, enabled the principles to be derived which were conducive to the establishment of suitable furnace atmospheres for the low heating of critical steels. Briefly they related to the mode of movement of the fuel through the fuel bed of the stoker, the relation between primary and secondary air, for particular types of coal, and the establishment of the correct type of turbulence to induce rapid mixing of air and combustibles in the combustion chamber. The emission of smoke was decreased by an increase in the following factors—the amount of excess air, the velocity of the secondary air, the number of jets used for admitting the secondary air, and the combustion chamber temperature. Coal could satisfactorily be burnt in a restricted combustion chamber with a small amount of excess air, 10-20 per cent, by means of an adequate provision of turbulence, requiring essentially high jet velocity, rather than volume.

Conclusion

A technological report of a more detailed character is available for those interested more deeply in the technical features of the work. The smoke problem is due to two main causes, (i) the use of old-fashioned appliances and outmoded techniques, for which there may be no valid scientific reason, and (ii) the lack of application of existing knowledge either from lack of interest or ignorance. The second cause is a sociological problem. To some degree

(*concluded on page 136*)

NEWS

Smokeless Zones

Glasgow Corporation has announced the area of its proposed first smokeless zone in the centre of the city. It is bounded by Hope Street, Clyde Street, Albion Street, George Street, and Sauchiehall Street. A three month survey is being made and on the basis of this a decision will be taken on whether to proceed with or to delay the scheme.

Bradford is considering proposals which may lead to the establishment of 20 smokeless zones.

Walsall Town Council have been considering whether the tenants on the new Mossley Estate should be required to sign an agreement to burn only smokeless fuel.

A plan to make the 900-house Holts Estate, in Oldham, a smokeless zone has been turned down by the Housing Committee. The Chairman of the Committee, Alderman J. Bannon, is reported as having said that Oldham got Manchester's smoke on the prevailing wind and until Manchester made more progress nothing that Oldham did could be very effective.

Salford has prepared plans to establish smokeless zones in the Fairhope and Ladywell districts of Pendleton.

Representatives of local authorities with smokeless zone powers met in conference with officials of the Ministry of Housing and Local Government on 11th February.

Testimonials about Manchester's smokeless zone continue to come in. A member, with an office in the central part of the city writes to say "I consider the smokeless zone in Manchester a great success. The snow on the windowsill of my office, first floor, shows no smuts after lying 24 hours."

Manchester, which hopes to add 130 acres to its existing 103 acre smokeless zone in the city centre in October, has had only one complaint lodged against the proposal although the extension contains nearly 1,200 tenants who will have to change to smokeless grates and appliances. Already the Watch Committee has agreed to spend £4,600 on converting the Central Fire Station and the 43 houses attached to it to meet the smokeless zone requirements.

Speaking at Edenfield, near Bury, recently, Mr. Anthony Greenwood, M.P. for Rossendale, said that damage to the Houses of Parliament by atmospheric pollution had "run up a bill for more than £2 millions." He said that the Government should introduce a bill to give local authorities full powers to set up smokeless zones, and welcomed proposals by Lancashire County Council to promote a private bill which would give smaller urban authorities, who could not afford private bills of their own, legislation to set up smokeless zones.

Mr. Robert T. Griebling, Executive Secretary of the Air Pollution Control Association of America since 1951, left the Association on 1st February, and has been succeeded by Mr. Harry C. Ballman, who was previously Smoke Regulation Engineer of the City of Columbus, Ohio.

The Town Clerk of Huddersfield has sent out a letter to industrialists in the town referring to the byelaws relating to smoke and appealing for the co-operation of all concerned in an endeavour to reduce the amount of smoke emitted. The letter concludes by saying that the Corporation wish "to make it known that they are determined to insist on the observance of the byelaws and, if necessary, to take proceedings against offenders."

Smoke and the Law

The Need for a New Approach

From a Paper by Arnold Marsh to a Joint Meeting of the North West Section of the Institute of Fuel and the North West Division of the Society, at Liverpool on 3rd December, 1953.

The Present Law

The control of smoke by legislation, other than the medieval ordinances, dates back to 1845 and 1847, when sections relating to its abatement were included in Railway and Town Improvement Acts. It was however not until 1875, in the great Public Health Act of that year, that legislation as we still know it was made effective. The next step was the Public Health (Smoke Abatement) Act of 1926, now a part of the consolidating Public Health Act, 1936 and of the Public Health (London) Act, 1936.

The provisions for the prevention or abatement of smoke that we find in the 1936 Act are essentially the same as those of the 1875 Act, and the principles in use today are thus the same as those of over three-quarters of a century ago—a period which has seen unparalleled technological change.

It is true that the 1926 Act sought to bring about a number of improvements, which following the report of the Newton Committee of 1920 had been pressed for by those concerned with smoke abatement. With one exception, however, the more important improvements have not in fact been operable, so that the advance made in 1926 has been largely illusory.

The Limitations of Existing Law

In summary form these may be listed as follows:

(1) The law is concerned only with smoke after it has been emitted. There is no attempt to control the conditions which give rise to smoke. Building regulations that came into force only when a structure had collapsed, or flying regulations only after a crash, would be regarded as futile, and for fuel-burning installations to be subject to approved standards is surely both logical and necessary. The principle of prior approval is accepted for many things in this country and for smoke prevention in other countries.

(2) The main clause of the Act—section 101—is technically not easy to work, though a few authorities appear by long practice to have built up a satisfactory procedure. It requires proof that a " nuisance " has been committed, and gives the defendant the defence that he has used " the best practicable means " to prevent it.

(3) Section 104(1) was designed to make procedure simpler by defining what a nuisance was in terms of actual smoke emission, but this suffers from the double defect of (a) requiring a byelaw to be applied for by the local authority and granted by the Ministry, and (b) being restricted to *black* smoke only. The Act was clearly intended to apply to other forms of objectionable smoke, but after it was passed all efforts to obtain byelaws for anything but black smoke completely failed.

(4) The second part of section 104 was a first, though limited, step towards prior approval, and relates to the inclusion in the building byelaws of provisions to require in new buildings (other than private houses) " of such arrangements for heating or cooking as are calculated to prevent or reduce the emission of smoke." The abortive discussions between the Ministry and local autho-

rities made it clear that " heating " was intended to refer only to " warming," but even so no satisfactory form of byelaw was devised and the sub-section has therefore remained a dead letter.

(5) Section 109 of the Act kept alive the 1875 virtual veto on action against a number of mining and metal working processes, despite the objection of the local authorities concerned. In Parliament, during debate on the Bill, assurances were given that the exempted processes would be reviewed at the end of five years. Twenty-eight years have now elapsed, but that revision is still awaited.

Modern Trends

The attitude towards smoke abatement that prevailed in 1875, based on the inevitable limitations of that period, is still with us and colours our approach to the problem. It is that legislation should simply attempt to *moderate* smoke; to restrain emissions from going beyond arbitrary " nuisance " limits: but doing nothing whatever to prevent, abate or reduce emissions that do not exceed those limits.

The excessive industrial emissions against which action can be taken under the existing law, deserving though they are of vigorous action, may nevertheless create only a fraction of the mass of general pollution arising from chimneys against which no action is possible. If we wish to reduce this general pollution then the nuisance abatement provisions, necessary though they are, must be recognized as being only a *part* of the legislation that is needed. The other part, concerned not with nuisances but with the avoidance of the emissions that together make up the general pollution, hardly exists as yet in this country.

The first and most obvious requirement is what is called prior approval. As has already been mentioned, this principle is applied in many other fields, where it is accepted and is made to work efficiently and usefully. It is used for smoke prevention in the U.S.A., Canada, European countries, and in India. It was found in Germany by members of the Newton Committee in 1920 and today it is the corner-stone of all modern legislation in the U.S.A., where it is willingly accepted by industry. Not only in the U.S.A. have plans to be approved, but operational certificates have in many cases also to be obtained after the job has been completed.

It is strange that we should be so tardy in adopting the principle, and it is strange, too, that there are signs that it is not accepted even today by some sections of industry. And yet it is difficult to believe that there can be any objection to the *principle* involved. If that is so, then any objections to its *application* must be matters of ways and means, and as such can surely be resolved to the satisfaction of all.

Prior approval has already begun in a limited way, not only by a few local authorities that have obtained powers in their local Acts, but also in certain cases through planning control under the Town and Country Planning Act. And we have yet to hear of any real difficulties arising, either here in Britain or overseas.

The use of prior approval can bring smoke emission down to negligible proportions in new plant, and in existing plant as and when it can be modernized. But what can be done about existing plant as we find it today—often obsolescent, overloaded, badly maintained and operated? Here we need better standards of permissible emissions, based not simply on black smoke, as in the present section 104 byelaws, but on the other types and grades of smoke that were presumably envisaged when the 1926 Act was drafted.

Taking all the factors into account it is difficult to suggest anything but a graded scale, such as we find in the Ringelmann chart, and it would be interesting to enquire into what extent this is in fact already used in this country, and whether it would find favour if the byelaws were not confined to black smoke.

New legislation should also be concerned with ensuring that plant is maintained in good working order and is efficiently operated. Some of the U.S. ordinances include power to seal plant that is not properly maintained and run, and desirable though that may be in theory it may be too early to demand it here. It should however be possible, in the case of plant that can be approved on conditions that it is run according to certain standards, to be able to revoke the approval if those standards are not observed.

Efficient operation means that the running of the plant should be in the hands of competent people, and new legislation should certainly contain provisions for the certification of stokers and boiler attendants, on a proficiency basis. This means ultimately a certificate issued after examinations, but at first a certificate should be granted also on grounds of experience.

In spite of all the improvements new legislation may make, a certain amount of smoke, diminishing though it may be, will have to be tolerated. Special efforts to clean up the black spots, involving domestic as well as industrial and commercial districts, have been suggested by the Beaver Committee, and in the form of smokeless zones by the Society. New legislation should therefore contain powers for the creation of smokeless zones, or other special areas, without the need for private legislation. This subject, and the problems that it raises, requires a paper to itself, and here it need only be said that although it should not be necessary for a local authority to have to seek special powers to set up smokeless zones, the actual establishment of such zones may have to be regulated, at Government level, according to the availability of new smokeless appliances and smokeless fuels.

In smokeless zones of the Manchester pattern all smoke is prohibited without qualification, but it is easy to see that if such zones are to expand into industrial areas, where bituminous coal must continue to be used (and where on smoke prevention grounds this may have to be encouraged to liberate smokeless fuels for domestic purposes), then the absolute prohibition of smoke may not be feasible. Such areas would in effect be similar to the City of Pittsburgh, which although now largely smoke-free, does permit No. 1 Ringelmann smoke at all times and No. 2 for limited periods. It may be preferable not to call areas of this kind smokeless zones, but that is perhaps merely a matter of terminology, and not of practical difficulty.

Most of this discussion has been concerned with smoke from industrial sources, and it is only by the smokeless zone principle that we can expect to make progress, other than vague and haphazard progress, with the prevention of domestic smoke. This requires the prohibition of the use of bituminous coal, and once more we may with advantage look to the American legislation, which is not concerned with watching domestic emissions, but simply with the fuel that is burned. The term “ authorized fuel ” is already found in our later smokeless zone legislation, and it is on such lines that progress must be continued, both for domestic and certain industrial or semi-industrial appliances. The Americans have found it desirable also to control the sale of fuel by the licensing of retail fuel merchants, but whether we can avoid this remains to be seen.

Administration

One of the drawbacks of the present legislation is that it is not only largely permissive in its application, but that it does nothing to ensure that adequate arrangements are made for its administration. Any new legislation should be concerned with these matters so that the law may be applied everywhere and in a uniform manner.

There have been suggestions that

the administration should be central, under the Government, and similar to, or by an extension of, the organization used for the administration of the Alkali &c., Works Regulation Act. Alternatively, the law might be administered by a small number of regional organizations; and finally it might remain in the hands of the local authorities as at present.

For various reasons there are advantages in control remaining in the hands of local authorities, provided always that this can be done efficiently. Where it cannot, then other arrangements must be made.

It must be borne in mind that what is being considered is not the better administration of existing law, but the kind of administration that will be needed to give effect to the new legislation that has been briefly outlined in this paper.

The requirements for efficient administration, which will include prior approval, smokeless zones, and periodical inspection of at least some installations, may be summarized as follows.

(1) There must be a qualified smoke inspector for every part of the country, and not merely for the larger towns and industrial areas.

(2) This means that each local authority must either have its own smoke inspector; or must combine with other authorities to form an area smoke abatement committee or board employing its own inspectorate. Finally, in districts where even such joint boards would not be feasible, or where there has been failure to establish one, the county council should be responsible.

The administration of prior approval powers admittedly needs careful consideration, but with the development of an adequate smoke prevention administration for the whole country—which must include the training of more inspectors and providing them with adequate technical knowledge and experience—there is no reason why administrative arrangements could not be made that will combine adequate control with full acceptance of the principle by industry. In most cases prior approval will be a matter of straight-forward approval, but where there are doubts and difficulties they should be put to a panel of advisers, which could include representatives of industry. For more unusual or complicated cases national or regional panels could be set up, or the equivalent of prior approval could be secured by other means, as it is already in the case of major installations such as electricity generating stations. The actual machinery is a matter of expediency, but there is no reason to believe that a system that works smoothly and effectively in the U.S.A.—which has quite a complex industrial set-up!—cannot be devised for this country.

In conclusion, it should be stated that the principles proposed in this paper for new legislation are in accord with those being submitted by the Society to the Beaver Committee, but the way in which they have been described and commented upon is entirely the author's personal responsibility.

Metallurgical Problems—*Concluded*

there are special technical problems remaining to be solved, but they are not the cause of the bulk of the industrial smoke produced. Where economic considerations and the nature of the scale permit, a solution of the problem may be found in the installation of mechanical firing or conversion to gas firing. The heating up of a cold furnace with coal requires the application of new types of appliance in which the combustion of the gases is completed before the products enter the cold chamber. The requirements of such an appliance have in some measure been worked out. The conclusions resulting from this research are in a very wide measure applicable to other forms of industrial as well as domestic firing. The technical details will be assembled in a series of technical papers to be presented to the appropriate scientific societies.

Fog and Smog

by A. L. Kelley,

*Director, Birmingham and Midland Institute Observatory**

In this atomic age when nations broadcast their achievements and boast about their civilization, we sometimes almost imagine ourselves as controllers of the universe. So that when the almighty hand of nature suddenly deals a catastrophic blow such as the East coast floods and the London smog of last winter, it comes as a shock to our self esteem and pride and, in the panic of the moment, we shout loudly for somebody's blood, usually that of the existing government and the particular department which is supposed to have the matter under control. If it is the weather then there is an attempt to blame the Meteorological Office, although perhaps no body of men realize their limitations in the face of nature, so well as the weather men.

Our first point to remember then is that as long as the present relations between the Earth and Sun are maintained and as long as there is sufficient water in the oceans and the heat to evaporate it, we shall have fog.

And as long as we pollute the atmosphere of our industrial areas, we shall run the risk of increasing the death rate by smog, although we may ultimately find a means of economically dispersing fog on a vast enough scale to keep the wheels of transport turning at a reasonable speed instead of being brought periodically to a full stop.

In the present weather services the system of recording fog is based on the surface visibility. If the visibility falls below 1,100 yards the weather man records fog, although if his atmosphere has a low degree of dampness or humidity, he will probably qualify his entry with smoke or dust haze.

The man in the street would never worry about fog if the visibility never fell much below 1,100 yards, and we need not be unduly alarmed if the Weather Forecast says " Fog " unless it is qualified by the terms " thick " or " dense."

When the visibility falls below 200 yards it is recorded as thick fog and as dense fog when it falls below 50 yards. Road traffic begins to slow down appreciably when the visibility falls to fifty yards or below, especially at night.

Let us consider the formation of fog in a simple way, in the lower layers of the atmosphere.

As you know, the atmosphere is made up of air masses of various extent which differ considerably in water vapour content and temperature. Some of the water vapour may be visible to the eye as cloud but there is usually a very large amount which is invisible.

Generally speaking, the amount of water vapour which a mass of air can hold, depends on its temperature. It is possible, in several ways, for a particular air mass to be cooled to a point where it can no longer hold all its water vapour in an invisible state and some of the vapour is condensed on the minute particles always present in the atmosphere and it becomes visible just as the steam does as it emerges from the spout of a boiling kettle. It may form a cloud above the surface of the earth, or it may appear at ground level as a mist or fog, or it may only show as drops of water on different surfaces.

The temperature at about which

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*Read at the meeting of the Midlands Joint Advisory Council for the Abatement of Smoke and Atmospheric Pollution on 15th December, 1953, at the Council House, Birmingham.

this condensation takes place is called the " dew point."

The amount of water vapour present in a mass of air is conveniently expressed in terms of its dampness or " relative humidity."

As an example, a mass of comparatively dry air at a temperature of 60°F at a particular moment has a relative humidity of 50 per cent but if we dropped the temperature to around 40°F the air mass would become very damp air with a relatively high humidity of about 100 per cent. and if we dropped the temperature still lower, some of the water vapour would condense and we should see mist forming.

All the clouds which we see in the sky and all the mist, or fog, which occurs on the earth's surface, is formed by this cooling process, always excepting, of course, the man-made mists and clouds of smoke and dust.

All this is of course a very sketchy account of the process involved in the formation of fog; the main point to remember is, that the cooling of air containing water vapour to a level below its " dew point," is the cause of fog.

What are the commoner conditions which cause this cooling to take place?

On any clear calm night, especially between the end of September and the end of April in the Midlands, the earth will lose heat by " radiation " at its surface and the air in contact with it will also become cooled. If the cooling is sufficient to drop the temperature of the air below its " dew point," fog may be formed.

This is known as " Radiation " fog and it is the most frequent type of fog to occur in the Midlands. It forms generally about dawn and may reach its maximum density just after sunrise. Usually it clears during the morning but can persist all day and sometimes longer, in the mid-winter months.

Fog is also formed when a comparatively warm and moist air-current spreads across frozen, or snow-covered, ground. Cooling takes place in the air in contact with the cold surfaces and fog is formed. It may be dense for a time but seldom persists for more than 36 hours. This is known as Advection fog. This fog may also occur when two air masses, one cold and the other warm, begin to mix.

The mixing place becomes a fog area which may be thick, especially on higher ground, and can cover a large part of the country. Except in patches, however, it seems to be thicker just above the earth's surface and causes less inconvenience to road traffic than the radiation fog.

As it is the condition which is most likely to lead to smog, as well as being the most common type of fog, we can concentrate a little more on Radiation fog.

If you ever listen to the weather forecasts issued by the Meteorological Office to the B.B.C., you will be familiar with the terms depression and anticyclone. Roughly speaking, a depression can be defined as an area of low barometric pressure and usually stormy and unsettled weather. An anticyclone, on the other hand, is an area of high barometric pressure, generally with fair weather and light winds. The conditions conducive to persistent radiation fog are found therefore in the anticyclonic system.

The main conditions then, which assist the formation of radiation fog are clear skies, an already damp atmosphere, light winds and a little turbulence or churning of the air in the surface layers. A dead calm is not so favourable for the formation of fog and generally produces dew only.

The damper the initial state of the air, the denser will be the fog which is formed. Cold air, being heavier than warm air, tends to drain from the higher ground to lower levels so that, more often than not, cooling sufficient to produce fog is attained in the valleys some time before it forms on higher ground. Fog also tends to form quicker over the open country with its damp fields, than it does in the central parts of a city where the air

A remarkable aerial photograph of natural fog at ground level.—Aerofilms, Ltd.

may not be quite so damp at the surface.

There are many nights during the winter months when everything seems just right for the formation of fog, but except for some patches on the low ground of suburban areas only mist is experienced. This makes the task of forecasting fog of the higher densities a much more difficult problem than would appear at first sight.

Smoke Fog

Let us leave this formation of ordinary water vapour fog and come to that bugbear of our present system of heating called smoke fog.

As you know, warming air or any other gas makes it lighter and a patch of warm air will therefore tend to rise through the cooler denser air which may surround it.

When we light a fire in the domestic grate the warm air and gases of combustion immediately above the fire rise up the chimney carrying with them the lighter particles of solid matter. Usually there is a breeze blowing across the top of the houses which helps to disperse the smoke.

The large particles of solid matter quickly filter out and fall to the ground but the invisible specks remain airborne much longer. In a large, built-up and industrial area, the smoke and dust drifts away in the wind forming the well known industrial haze, the effect of which is more nuisance to the city housewife and the departments responsible for keeping the buildings nice and clean. On the other hand it helps to maintain a colossal industry which manufactures the implements to clean up the mess!

There is however, on occasion, a more distressing and serious side to this smoke pollution.

It frequently happens that as night falls there exists a layer of air above the ground in which the temperature is higher than the air above or the air below. This state of affairs is termed " an inversion."

Normally the temperature falls steadily with increasing height but in the case of an inversion we find the process is reversed and the temperature increases with height at least for a time, although ultimately we should find the temperature conforming to the normal procedure and falling again with increasing height.

Warm air will continue to rise just so long as the air surrounding it is at a lower temperature but if that warm air reaches a point where the surrounding air is at the same, or at a higher temperature, then it will cease to rise. It is just as if it has reached an invisible ceiling.

When one of these inversions occurs over a city we find the smoke-laden air, instead of continuing its upwards movement, stops at the invisible ceiling and begins to accumulate, especially if there is little or no wind.

If the inversion layer is fairly high its main effect is to cut off daylight but if the inversion is low, the smoke gathers at the surface of the earth, considerably reducing visibility and, with some people, it renders breathing a difficulty. If the surface humidity is low we have formed a pure " smoke fog."

In the summer months the inversions are usually high but in the autumn, winter and early spring, they may be very near the surface. A very familiar indication, especially to gardeners, of the near surface inversion is shown by the spreading out of the smoke of a garden fire just a few feet above the ground, on a quiet, clear evening in the autumn.

The worst type of fog which can occur results when conditions favour the development of both water vapour and smoke-fog, near the surface, forming " smog."

Fog in the open country without smoke pollution rarely attains the density of the industrial area fog which can reduce visibility to two or three feet.

Should conditions favour the continuance of smog for more than 48 hours the effects on animal and human life can be in the nature of a catastrophe.

You will have realized by now that there are a number of " ifs " and " buts " about the possible formation of smog. In fact the weather of this country has a lot of " ifs " and " buts " about it, which makes forecasting smog or the weather as a whole, rather more difficult than in any other part of the world.

In the built-up areas of Birmingham and the Black Country, the general tendency seems to be for smoke fog to form in the evenings and water vapour fog to form in the early morning.

After about 10 p.m. a large number of household fires die out, the lower inversions lift and the smoke disperses.

Over the central built-up areas the thick smoke haze can tend to block the escape of heat from the ground and retard the formation of water vapour fog in the earlier part of the evening. In the suburban areas, nearer the open country with its damp gardens and fields, the formation of fog may be quicker and more likely to occur earlier in the night and especially in the lower-lying areas.

In this district we have not the same possibilities for persistent smog over a wide area, such as exists in London, which, lying in a large basin and close to the expanse of open water of the Thames estuary and the open sea, has its own particular problem.

The uneven terrain which exists in the Birmingham and surrounding districts and the absence of any large areas of open water or wide rivers are more conducive to the formation of patchy fog of very uneven density.

The higher levels tend to clear for a time during the day and it is a rare thing to find the whole of the city and the surrounding areas covered in dense fog at the same time, except for a few hours.

The intensive plotting at the Observatory of thick to dense fog over the last five years for the city area, shows that the most persistent fog occurs in the Hockley, Perry Barr and Tame valley districts, whilst black spots for rapid development of fog occur along the Rea, Cole and Blythe valleys, as one would naturally expect.

Our fog intelligence over the neighbouring towns of Dudley, Halesowen, Wolverhampton, Darlaston, Walsall, Wednesbury, Smethwick, Oldbury, and the rest, is at present rather sketchy, primarily because of the difficulty of setting up a reporting organization, nor have we the official standing to approach local authorities and ask for their assistance.

In Birmingham we have been extremely fortunate in that although we have no official status as a corporation department we have been able to obtain the co-operation of certain departments which, thanks to the kindness and courtesy of the chief officers of those departments, rendered our task of collecting simultaneous data on fog density, a comparatively easy task.

As we are also notified, throughout the foggy period, as the density varies or fog clears, we are able to note if the fog shows any tendency to stick in any one locality.

Some statistics of fog density over recent years may prove of interest.

It is perhaps worthy of note that in the long anticyclonic spells which occurred in February and March of 1953, dense fogs were only recorded at Edgbaston on three occasions and thick fog on nine, but on no day did thick fog persist all day.

Pure smoke fogs occurred on the 23rd and 24th of March. No persistent smog on the London scale appears to have occurred in this area within living memory.

At The Birmingham and Midland Institute at Edgbaston the number of days of certain minimum visibilities which have been recorded over the past five years are given in the following table, for the autumn, winter, and early spring months.

VISIBILITY	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MARCH	APRIL	
Yards									
220-440	5	19	17	5	17	15	19	5	Moderate fog
110-220	4	8	10	7	7	3	5	—	Fairly thick
55-110	8	6	6	3	1	2	2	—	Thick
22-55	—	2	3	—	1	2	2	—	Rather dense
0-22	—	1	2	—	2	—	5	—	Dense

Edgbaston may not be considered as a fair criterion but the number of cases of fog of the above character compares favourably with other places in the vicinity at about the same height above Mean Sea Level, 540 feet.

Lower lying areas would have correspondingly higher numbers of days with denser or thicker fog.

You will note that October, November, January and March seem to be the most likely months to produce dense fogs. It is perhaps only fair to add that of the 5 dense fogs recorded in March, three occurred in March, 1953.

Only about three of the total of twenty Dense, or Rather Dense fogs noted in the past five years commenced in the early evenings as possible smogs. Complete, or at least partial, lifting the following day prevented any serious consequences.

This may give you an optimistic view of things in the Midlands area and perhaps if we could take every factor into consideration which would affect the formation of persistent Smog in this district we might find that the chances were 1 in a million against a catastrophe of the London type.

As men who have the pollution problem very much at heart I take leave in my humble capacity as a

(*concluded on page 144*)

TOWARDS BETTER CONTROL OF INDUSTRIAL POLLUTION

Excerpts from a Paper by G. H. Wilkinson, F.S.I.A., Chief Sanitary Inspector and Cleansing Superintendent, Corby U.D.C., to the East Midlands Section, Sanitary Inspectors' Association, on 20th January 1954.

A study of books and documents dealing with the activities of sanitarians in the latter half of last century reveals comparatively little attention to atmospheric pollution, and even the rare references are generally to its nuisance potential only. This is understandable because our predecessors had more obvious and more pressing problems to deal with such as cholera, typhoid, and other diseases, polluted water supplies, foul drainage and sanitation, deplorable housing and so on.

The public awakening to the menace of smoke appears to have come immediately after the first world war. It may have been activated by the universal cry of "homes fit for heroes." On the other hand, attention may have been forcibly drawn to the nuisance because of the overloaded, obsolete industrial equipment used or brought back into service during the wartime emergency. The increased public interest resulted in the setting up of the Newton Committee in 1919. Between then and 1926 there was considerable activity in various local government circles, especially Sheffield, and in parliament. This was accompanied by considerable anxiety in certain industrial quarters, notably the iron and steel industry. All this activity produced the Public Health (Smoke Abatement) Act 1926, the provisions of which undoubtedly favoured industry. For that reason the Act was little improvement on previous legislation.

Interest in smoke abatement seems to have subsided after the passing of the Act. Doubtless a major reason was the enforced reduction of industrial pollution resulting from the trade depression of the early thirties. Since 1945, and especially during the past two to three years, there has again been a notable increase of interest in the subject. One reason might have been the series of post-war studies. Another is undoubtedly the re-occurring fuel crises. Public opinion is now, however taking a hand, as witness the abundant press publicity since the London fog of December, 1952. Regrettable though the incident and its effects on humans were, this incident must have shaken the complacency of many, and undoubtedly gave a decided fillip to the movement for cleaner air. The consequence has been the setting up of the Government Committee of Enquiry, (The Beaver Committee). May we express the hope that its findings, unlike those of the Newton Committee, will be followed by effective action.

The National Smoke Abatement Society and the Fuel Research Station can report recent advances in membership, co-operation and interest. Nevertheless, individuals will agree that these advances are far too slow in the face of the ever increasing urgency of the problems to be solved. With all due respect to local government, and acknowledging the splendid work of many local authorities and their officers, it is my opinion that atmospheric pollution has been for far too long the cinderella of the sanitary services.

Legislation

Present legal powers, including local byelaws, are woefully inadequate as a support to the modern requirements of air pollution control. They are an obvious survival from the days when preventive medicine had to concentrate on more important problems, happily long since solved. It is an item of legislation which has failed to advance a century of public health achievements. Here one might usefully compare the provisions of the 1936 Act with those of Palmerston's Act of 1853, just a century ago. This measure could be described as the first true Act for the Abatement of smoke. Its purpose was " to abate the nuisance arising from the smoke of furnaces in the Metropolis and from steam vessels above London Bridge." It required industrial furnaces to be " constructed or altered so as to consume or burn their smoke." The relevant section, however, included a provisional clause—" Provided always that the words ' consume or burn their smoke ' shall not be held in all cases to mean ' consume or burn all their smoke.' " Thus was industry protected, and has remained protected throughout the intervening 100 years.

Present legal powers are based, not on prevention, but on cure by prosecution after an offence has been committed. Some one may say that planning powers are preventive. I agree; but they have a limited value only. In the matter of normal fuel-burning appliances etc., these powers ensure the installation of efficient plant and the essential ancillary equipment for preventing pollution. But once the plant and equipment are installed, the powers cease, and the proposer is free to use the plant as he wishes—intelligently or otherwise.

In regard to specialized industrial processes which do not employ normal fuels or follow the general pattern of furnace operation, the powers are still more limited. Several examples of these processes can be noted in the metallurgical industry. They have been developed after years of research and repeated modifications by specialist technicians. Nevertheless they can be responsible for considerable air pollution, and the problems may be very difficult of solution. Can a local authority or any of its officers be considered competent to demand modifications, improvements or additional equipment in order to prevent pollution, and yet not interfere with the process under consideration? Would not the holding of such a view be tantamount to saying that local government was better qualified than industry's technicians to judge industrial plant?

Everyone interested in the subject of air pollution in relation to health and welfare of the community, is aware of the dangers inherent in the close proximity of industry and homes. Planning law is supposed to prevent the evils of bad siting of industry. Yet examples of recent bad planning can be seen in various parts of the country. Corby is one example. A residential estate of some seven hundred dwellings has been laid out on high ground alongside the boundary of the local steel works. In South Wales, the much publicized Margam steel works is sited on the sea-shore, with steeply rising mountains immediately to the rear of the town of Port Talbot. Doubtless it was not the planning powers which were at fault, but the people who failed to implement those powers.

Reference must be made to smokeless zones. This type of legislation is essentially preventive and is therefore ideal. It must, by its very nature, be a long term project; but no one can doubt its eventual value to the community. Unfortunately, the great majority of local authorities cannot afford the expense of the essential preliminary work on existing areas, and the costs of a private Bill. Even where an authority can afford these expenses, the central government fails to give its support, as in the case of Salford. Reference must also be made to Nottingham where a voluntary scheme has created a smokeless residential zone at very little cost to the Council. Nottingham would, however, agree that such a scheme could not be applied to an industrial area unless there was 100 per cent co-operation from the industries and commercial firms concerned. Unless there are revolutionary changes in methods of production, the setting up of smokeless zones in certain industrial areas will be hampered by the presence of industries from which heavy pollution appears, at present, to be inevitable e.g., coke ovens plant.

A number of suggestions for inclusion in future legislation have been publicized. I am not going to list them here because everyone will be aware of them. Many of these ideas have already been included in American legislation and have proved very successful. On the other hand, references have not been seen to certain powers which the Americans have included. For example. there is the power to " seal " a plant or piece of equipment which has caused violations of smoke laws. This sealing means that the plant or equipment cannot be used until the control department is satisfied that it can be, and will be used without causing a violation. It is enforced only as a last resort, but the mere threat of sealing appears sufficient to prevent the more serious cases of pollution. Again, in the case of repeat offences, the control officer has the power to summon to his office those responsible for the violation, to show cause why the offending plant should not be sealed. This summons applies not only to the actual operator and the manager, but also, if necessary to the highest executive. Who can doubt the benefits of such interviews?

It is essential that the central government encourage initiative within local government to increase legal control of pollution. There are many examples of proposals for byelaws being vetoed by the Ministry for inexplicable reasons, or only agreed to after a bitter struggle and modifications to proposals. All the local byelaws so far accepted have related only to black smoke. Would it be true to say that any local authority proposing byelaws which relate to any other type of pollution can expect automatic rejection of the byelaws? Is it not incongruous that a government department which sets up a committee of enquiry into atmospheric pollution, should at the same time stifle any attempts by local authorities to introduce more effective legal control of the nuisance?

As regards future legislation, both national and local, it is essential that it be preventive in character, deal with pollution at source, and be wide enough to cover all types of pollution. Any penalties (and I do not confine these to financial penalties) should be such that they provide an incentive to the potential nuisance producer to take preventive measures whatever the cost. It must no longer be possible for industry to plead expense as an excuse for not preventing or mitigating pollution. The practice of preventive medicine requires that public health should have prior consideration over all other factors, including any financial factors.

Fog and Smog—*concluded*

weather man to draw your attention to one fact. Within a radius of ten to twelve miles of the City centre the land is fast becoming a built up area. Thousands of chimneys are being added to this district each year and it is fairly safe to assume that, unless circumstances alter very quickly sixty per cent of those chimneys will add their quota of smoke to the air. Not so much because the people like breathing a smoky air, or the cleaning up of filthy ash in the morning, but because for the amount of heat per " stoke up " which can be obtained and the cheerful blaze which suggests warmth and comfort, coal is still the cheapest form of domestic heat obtainable despite the protestations of the experts. And whilst " smog " in its worst form may be a remote possibility at present, it may become a devastating fact for some part of this densely populated area and it will not be to the meteorologist that you must look for your scape-goat although I must confess that I am one meteorologist who still burns coal on my home fire.

Cement Dust in Kent—and Parliament

The Thames-side Advisory Committee on Atmospheric Pollution is co-ordinating a petition for a public inquiry into the cement dust nuisance by the residents of Stone, Swanscombe and Greenhithe. This body, which was formed by the local authorities affected by the dust nuisance, has for some months had deposit gauges positioned in the area. Deposits indicating a fall of more than 80 tons per square mile per month have been recorded, between 40 and 50 tons of it from cement works.

According to a *Times* report, the residents complain that on occasions a deposit can be seen on a blue suit or overcoat after a walk in the open, and indoors a woman can write her name in dust on her furniture.

Complaints have been received from communities as far away as Chislehurst and the local authority at Orpington has also come into the discussions.

Questions in the House

On 19th January, Mr. Norman Dodds, M.P. for Dartford, asked the Minister of Housing and Local Government what reports he had received from his inspectors about the conditions experienced in December over a wide area of North-West Kent, as a result of heavy deposits of dust from cement works; and, in view of previous representation made, and undertakings given, what action he now proposed to take to ensure that the local residents were made reasonably free of this nuisance.

Mr. Macmillan said he was advised that there was at present no known method of completely eliminating dust from cement works. The dust-arresting plant in use at the Thames-side works, when in full operation, attained a high degree of efficiency, but a small proportion of the dust escaped, and the total escaping from a large number of kilns was enough to give rise to complaints in dry weather. These problems still awaited solution, but they were receiving constant attention from his inspectors and the cement manufacturers.

Mr. Dodds asked if Mr. Macmillan recalled that early in 1953 it was suggested that if the machinery was in order the matter would be satisfactorily settled. As there was no doubt about dust coming from many other factories, would he not hold a public inquiry which many people were requesting.

Mr. Macmillan said that if the machinery was working satisfactorily, 95 per cent. of the dust was dealt with, but there was trouble when the machinery was out of action for repairs. The best thing was to press on with the best technicians and experts, to see whether a solution could not be reached. He did not think that a public inquiry would do the work that could only be done by expert technicians.

Mr. Edward Heath, M.P. for Bexley, made representations to the Minister of Housing recently on the cement dust nuisance. He had received a complaint from the Bexleyheath Ratepayers' Association and Mr. E. G. D. Hughes, the Association chairman, had alleged that another large deposit of dust had fallen on the borough. Mr. Hughes protested that the "best practicable means" were not being used under the 1906 Act to prevent dust falling, and urged that more stringent legislation should be enacted.

In his reply Mr. Harold Macmillan refuted the allegation that the law was not being enforced. He said that a programme has been drawn up for the overhaul of some of the precipitators during the winter and a large unit shut down in October should be working again by the end of January. Two precipitators stopped for repairs in November and December were now going again and a large one at a Swanscombe works was being completely rebuilt to an improved design. A new unit was to be installed at Wouldham.

The problem was a practical and technical one and it was being tackled vigorously and with some success.

Minister's Visit

Following complaints from Local residents about the cement dust nuisance, Miss Pat Hornsby-Smith, Parliamentary Under Secretary, Ministry of Health, and M.P. for Chislehurst, recently spent three hours on a fact-finding tour of four cement works of the A.P.C.M. in North-West Kent and visited the A.P.C.M. Research Laboratories at Greenhithe. The works visited were Johnson's, Kent, Swanscombe and Bevans. It is reported that about £370,000 has been spent since the war on repairing and replacing dust precipitation plant at three of these works. The fourth was an old works and presents a major problem. The installation of electrical precipitators there would require the demolition of existing equipment and extension of plant over land unsuited to heavy engineering installation.

Statement from the Industry

At the Eighteenth Annual General Meeting of Chinnor Industries Limited, Mr. F. W. R. Douglas, the Chairman, commented, in his circulated statement, on complaints of dust emission from the firm's cement works. After mentioning the placing of orders for improved and additional dust collecting plant during the past year the statement reads: " Due to abnormal atmospheric conditions last spring there were complaints of dust emission by residents in our neighbourhood. It has always been, and will continue to be, our policy to eliminate as far as possible the emission of dust from our works, not merely from the point of view of preserving the amenities of the district but also in order to improve the working conditions of our employees and to effect economies by avoiding this waste of our products. Unfortunately, the dust problem throughout the industry is far from being solved, in spite of intensive research, and progress in this matter is still slow."

Members of the East Midlands Division during the course of a visit to the Kirkby Colliery, Notts.

New Smokeless Fuel Processes

The reserves of good coking coals in this country are rapidly becoming exhausted and production costs are relatively high. The development of new processes for the production of solid smokeless fuel is needed if we are to obtain the quantities required for a domestic smoke prevention programme on the scale that is necessary. Two recent papers have discussed this important problem from different viewpoints.

At a joint meeting of the Institute of Fuel and the Coke Oven Managers' Association (Southern Section) in London on 12th January last D. T. Barritt and T. Kennaway, of Simon-Carves Ltd., described new processes for producing coke from a wider range of coals than can be carbonized by normal coke-oven practice.

After reviewing the development of the coke oven up to the present day the authors defined the inherent limitations of coke ovens with regard to their operational characteristics and to the narrow range of coals which can be carbonized in them. The importance of developing alternative processes, capable of producing satisfactory coke from non-coking or weakly coking coals, has been recognized by the organization for European Economic Co-operation. Their Working Party's report, published earlier last year, classified and have technical details of all known processes.

In their papers the authors examined three new processes selected from that report, namely: (1) the National Fuels process; (2) the Brennstoff-Technik process; (3) the Baumco process. In each case the basic theory of the process was outlined and a general appraisal made of its scope and possibilities in relation to existing practice.

These processes were serious attempts to widen the range of coals from which smokeless fuels could be produced, covering in particular the weakly coking coals which occur too abundantly and which cannot by themselves be used for coke making in orthodox plant. " A successful process offering such extended facilities," they concluded, " would be of the most profound significance. In Britain, it would enable much-needed supplies of smokeless domestic fuel to be made available and could encourage the installation of modern, economical, clean household appliances, greatly to the benefit of urban atmospheres. In all countries, and especially in those having a growing metallurgical industry but little coking coal, it would offer a substitute for blast-furnace and foundry coke as well."

In a paper to the Institute of Fuel in London on 23rd February, 1954, H. Bardgett described experiments undertaken at the Fuel Research Station to find to what extent low-rank coals of Types 400 and 500 can be used in coking practice in blends, in replacement of a proportion of the good-quality coking coals of Type 301. This problem was of the highest national importance since the very limited reserves of Type 301 coal in this country were being rapidly exhausted.

The experimental work was done in two Woodall-Duckham intermittent vertical chambers of mean width 11 in., heated by producer gas from a built-in producer. Comparative tests carried out before the war on coke from this plant had shown that they were similar in properties to cokes produced from the same coals carbonized in coke ovens, and consequently there should be no difficulty in applying the results of experiments in the intermittent vertical chambers to commercial coke-oven practice.

From Our Photo-Library — 19 *Aerofilms, Ltd.*

London

PICTURES FROM THE AIR

Our readers will recall that we have in the past reproduced remarkable aerial photographs supplied to us by Aerofilms Ltd., examples of which appear above and on page 139, but not until recently did we have the opportunity to talk with the men who take these pictures. The occasion was an informal gathering in London when Aerofilms introduced their new catalogue and exhibited a collection of photographs from the air in colour—a new development.

There were occasions, we were told by the cameramen, when they were assigned to photograph areas or installations, but work would be held up for several days waiting for a change in the direction of the wind which was carrying a belt of smoke over their objective from a nearby industrial district. Many examples, however, of pictures taken under these conditions are contained in our collection, and we have been promised more in the future.

Their new catalogue, which is a carefully planned and splendidly produced, classified publication, contains many striking examples of aerial photography ranging from ancient furrows in Warwickshire to shipbuilding on the Clyde. These have been selected from their collection of over 100,000 photographs. Copies of the catalogue can be obtained from Aerofilms Ltd., 29 Old Bond Street, London, W.1., at 7s. 6d.

SMOKE PREVENTION ABSTRACTS

206. Atmospheric Pollution in Canada. Katz, M. (Chem, Can., **4,** 8, 25-31, 1952.) The problem of atmospheric pollution in some smelting districts, and urban areas is reviewed. The main pollution in smelting districts is due to sulphur dioxide and fluorine from the refining of metal sulphide ores, and arsenical dusts from the smelting of gold bearing ores. Pollution of city areas is due to incomplete combustion of coals and liquid fuels which releases sulphur dioxide and other gaseous and aerosol contaminants into the air, causing mists and smog. The effects of these contaminants on vegetable growth, and on human and animal health are discussed. Suggested methods of control include the dispersion of waste gases and smoke through high stacks, chemical recovery of sulphur dioxide and hydrogen sulphide from stack gases, and the use of precipitators, scrubbers, and filters for the removal of aerosol contaminants. B.A.

207. Bad Air. (Sci. Amer., **188,** 32, p.34, Jan. 1953) Southern California recently had five weeks of " Los Angeles " smog. John T. Middleton, in charge of an air pollution research project of the University of California, estimated crop damage at $500,000 and blamed the smog on hydrocarbons produced by petroleum industry operations. This view is shared by A. J. Haagen-Smit of California Institute of Technology who believes that the principal smog producing materials are the two interacting substances oxide of nitrogen and gasoline. He attributes the worsening of the Los Angeles problem since 1940 to the introduction of catalytic cracking which yields unsaturated hydrocarbons. About half of the 2,000 tons which get into Los Angeles' air daily are from refineries, and about half are products of incomplete combustion in automobiles. One of the chief sources of the gasoline vapour is the open skimming ponds at refineries, where pools of petroleum bake in the sun.

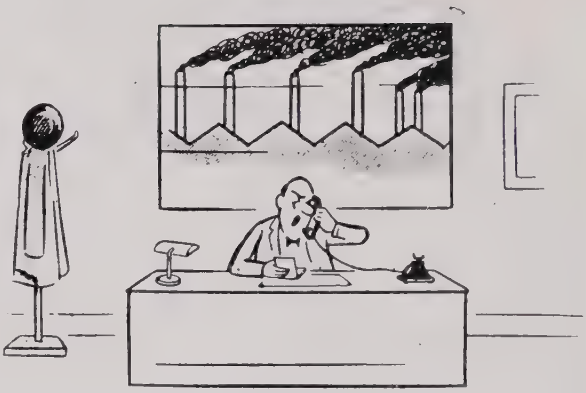
208. Coal Partial Combustion Process Reduces Soot and Smoke. (Chem. Engng. News, **31,** p. 2305, 1 June 1953; Mech. Engng. N.Y., **75,** p. 572, July 1953.) A process, developed by E. I. du Pont de Nemours and Co., for converting coal into synthesis gases may help solve air pollution problems while also bringing about more efficient use of coal. In the process low fusion ash coal is pulverized in steam driven jets. The powdered coal is blown into a ceramic-lined furnace where the volatile matter and fixed carbon are burned to carbon monoxide and hydrogen. Some of the carbon monoxide will be used in the manufacture of ethylene glycol and other products, and the rest will react with steam to give hydrogen and carbon dioxide, which are readily separated. Hydrogen and nitrogen, the latter obtained in the production of oxygen from the air in separate equipment, will be used in making ammonia. Most of the ash will be drawn off as slag and lightweight particles will be caught in filtering equipment. W.D.

209. Off-Peak Heating. (Elect. Rev., Lond., **153,** 404-406, 21 Aug. 1953.) An electrical heating installation to provide the whole of the steam cooking, space heating, and domestic hot water supplies at J. Sainsbury's canteen in Southwark is described. Electricity is consumed only during the night, and the heat is stored and is available in storage vessels for use during the twenty-four hours of the day. A boiler, rated at 150 kW and capable of giving 500 lb./h of steam at 80 lb./sq. in., supplies the steam. B.E.A.

210. Festival Hall Heat Pump, P. E. Montagnon, (Inst. Fuel, London, 22 Dec. 1953). The paper gives an account of the heat pump installed by the Ministry of Fuel and Power at the Royal Festival Hall through the stages of developing the various components and the installation and operation of the plant. The prime movers for the heat pump were Merlin aircraft engines converted to run on town gas and arranged to drive centrifugal compressors. The development of the engines' compressors and the high-speed rotary sealing units proved to be the most difficult task. The output of the plant was some 9 million B.Th.U./hr., which proved to be vastly in excess of the average requirements of the Festival Hall, in spite of the original estimate that the peak load on the hall would be over 25 million B.Th.U's/hr. An analysis of the performance of the plant has led to the suggestion that a plant of this type might be installed at a cost of some £52,500 and that it would burn town gas at an effective efficiency on peak load of about 1.25. A favourable overall economic picture for such an installation can be made when summer-time refrigeration is a desirable feature of the building concerned, in which case it is suggested that the heat pump should be designed to have an output based on the refrigerating load rather than the heating load.

In America the Automobile Manufacturers' Association has formed a committee of experts under the direction of John M. Campbell, administrative director of General Motors Research Laboratories, to investigate possible effects of automotive exhaust gases on air pollution. Members will visit Los Angeles to study theories developed and experiments conducted there on the causes and effects of smog. They will also visit the West Coast area.

" Public opinion must be stirred to demand a cleaner and purer atmosphere in towns " said Mr. G. W. Farquharson, Honorary Secretary of the West Midlands Division of the National Smoke Abatement Society, when addressing over 200 members of the Birmingham Women's Gas Circle at their Conference on the 19th November, 1953. He emphasized his talk with examples of vegetation, brick work and fabrics, showing evidence of deterioration caused by the effects of acid and soot deposits. He indicated the vulnerability of textile fabrics, especially those within the cellulose group, and maintained that appreciable reduction in the emission of smoke from domestic appliances is still desirous even in the so called approved appliances, and he appealed to all women and householders generally, to back up the efforts of the Smoke Abatement Society by pressing, through their organizations and Local Councils, for steps to be taken to ensure a purer atmosphere, and thus alleviate the ravages which impurities in the air wrought on both human beings, buildings and the social life of everyone.



" *Hello—Works? There's one of these Smoke Abatement chaps . . . .*

. . . . just coming in to see me . . . "

(*By permission of the Proprietors of " Punch "*)

Netherlands State Mines will start production of Synthracite, a synthetic anthracite, this year. Smokeless and odourless, this fuel is claimed to be fully equivalent to the best quality anthracite. For the time being production will be small.

As a precaution against a recurrence of the smog which caused several casualties among animals exhibited in December 1952, the organizers of this year's Smithfield Show had baffles fitted to some of the entrances to the exhibition hall at Earls Court to shield the livestock, numbering nearly 1,250, from draughts.

Allegheny County's Report

The 4th Annual Report of Activities of the Allegheny County Bureau of Smoke Control, for the year ended 31st May, 1953, has just been received. Under the direction of Thomas C. Wurts the Bureau is making a great success of its many-sided efforts, and the report is an outstanding testimonial of what can be done in smoke prevention. It is all the more impressive for the sober, factual picture it presents, indicating not only progress but problems yet unsolved. Coal steel, cement and other heavy industries create the problem that is being tackled, and now control has been extended to all domestic premises using hand-fired coal-burning equipment. The report says of this:

" As was to be expected, there were numerous protests and petitions to have the deadline for home-owners extended, even though a four year grace period had been given in the Ordinance. The Board of County Commissions very wisely issued a statement to the effect that there would be no extension of the date in this regard and the protests rapidly died away.

" The retail coal merchants have been co-operating fully and give us assurance that only proper fuels for hand-fired domestic equipment will be delivered by them. They have also refused to fill up the bins of home-owners with high volatile coal prior to the June 1st deadline in spite of numerous requests for such fuels."

Note also this: " The Bureau continues to receive comments from various parts of the County in regard to improvement of vegetation. This has been particularly noticeable in instances where previously there existed barren hillsides adjacent to industrial plants. These are now being covered by vegetation."

Research and special reports from the different industries are included, and one senses both the firm administration of the Bureau and the remarkable co-operation being given by industry.

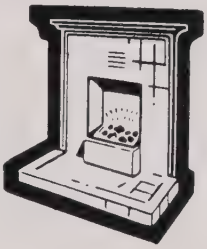
A NEW OPEN FIRE

We illustrate the new " Hurdapta " Fire, manufactured by Hurseal, Ltd., 229 Regent Street, London, W.1., from whom full details may be obtained. The fire gives both radiant and convected heat and is claimed to meet the conditions laid down for a new open fire by the Ridley Committee. The appliance is complete in itself, requires no bricking up or special fireback and no alterations to existing fireplaces. A special plate fits over the opening to convert it into a slow-burning stove. Combustion control is obtained by a flue damper and an air regulator, which enable all types of solid smokeless fuel to be used satisfactorily. The price is £9 19s. 6d., including flue pipe and flue register plate.

SOLID SMOKELESS FUELS

The Solid Smokeless Fuels Federation

is a group of organisations responsible for practically the total production of solid smokeless fuels in Great Britain, amounting to 38,500,000 tons per annum. One of the main objects of the Federation is to ensure that solid smokeless fuels are used as efficiently as possible. The combined technical and scientific resources of the Federation, in association with appliance makers, are continually employed in developing high efficiency equipment both for the home and for industry.



The advantages of Solid Smokeless Fuels

Solid smokeless fuels give a *higher* proportion of *radiant* heat than household coal. Consequently you get more useful heat from approved domestic appliances at a *lower* cost for fuel.

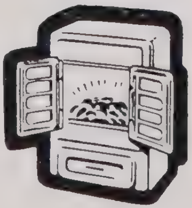
Appliances designed for solid smokeless fuels provide easy and accurate control of the rate of burning and heat output. This makes them extremely economical to run, and capable of long burning periods and overnight banking, thus saving work and attention.

Solid smokeless fuels are graded in a wide range of sizes and in a variety of types to ensure satisfactory performance in all domestic appliances.

Modern solid smokeless fuel appliances usually incorporate a built-in gas burner or gas poker. Lighting up is therefore simple, clean and convenient. No wood or paper is required.

These fuels are smokeless and sootless. They save dirt and work in the home and help to keep house furnishings and paintwork clean.

Solid smokeless fuels are conducive to better atmospheric conditions and improved standards of health.



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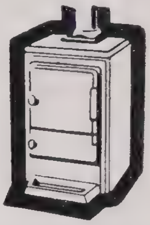

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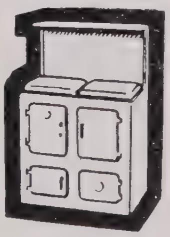

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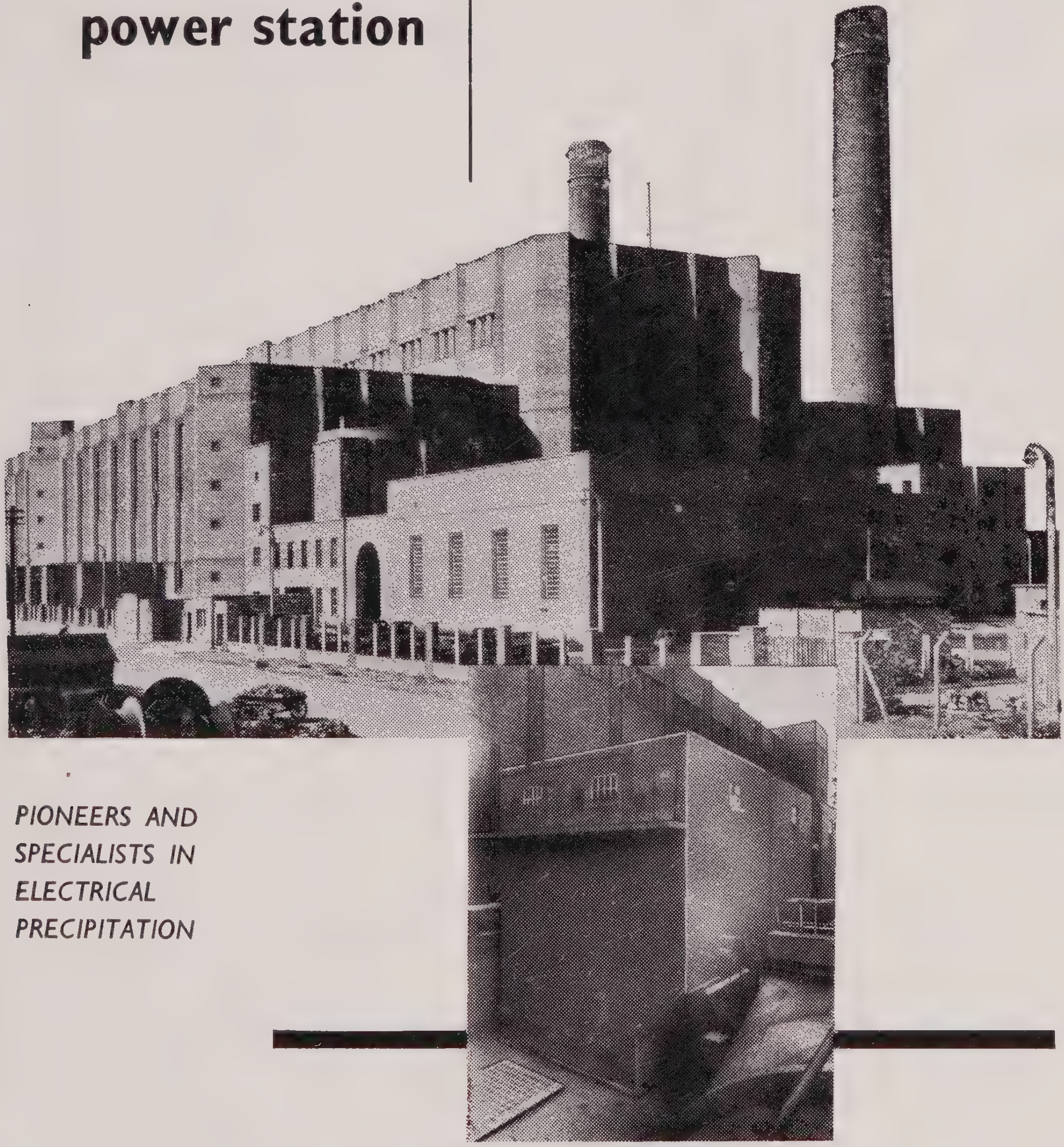

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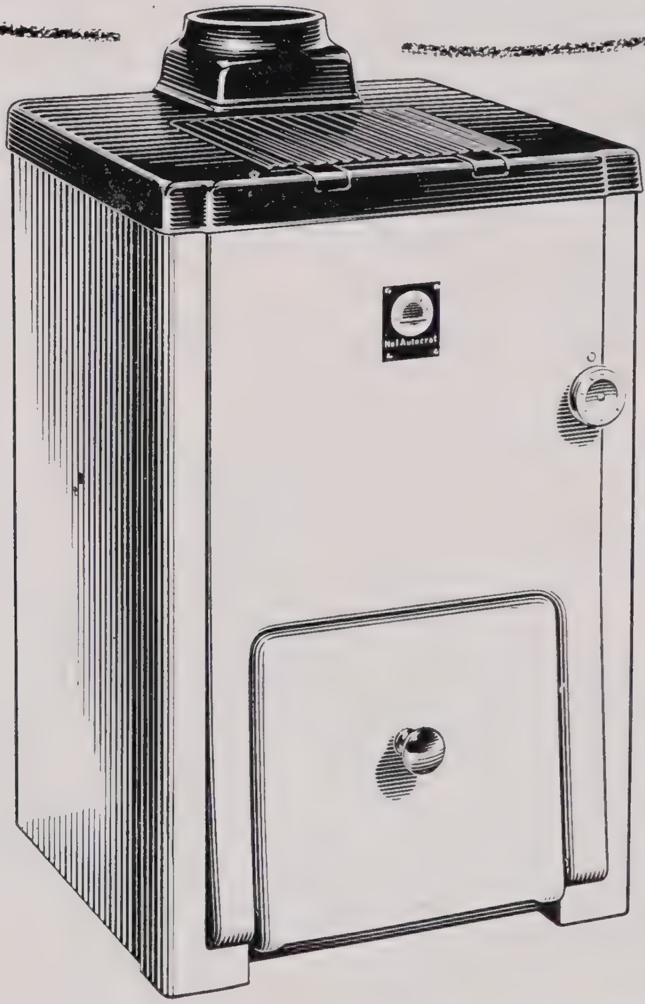

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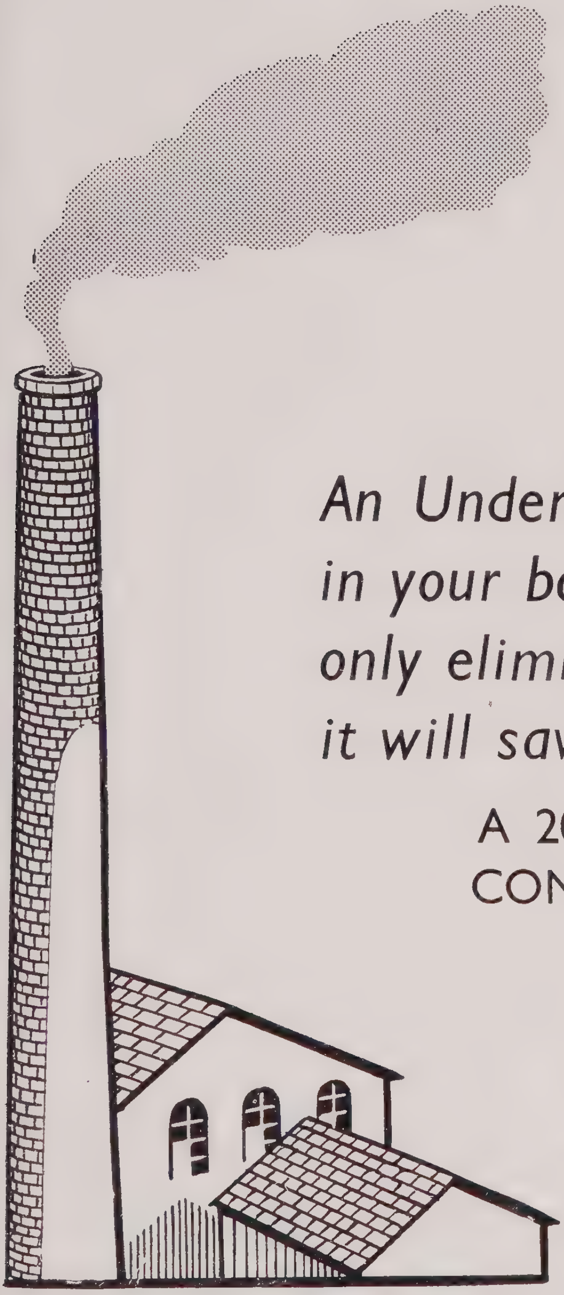

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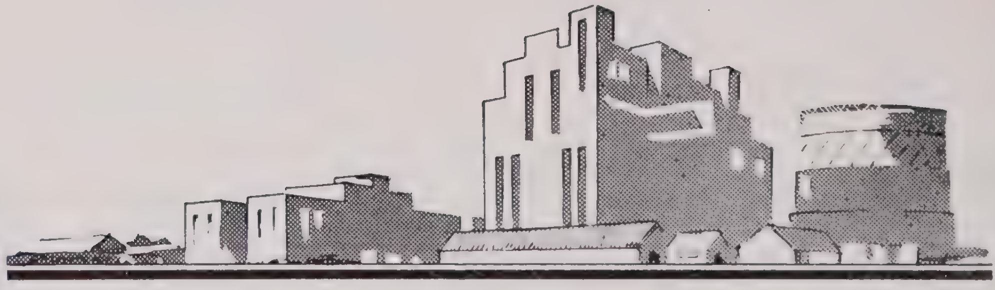

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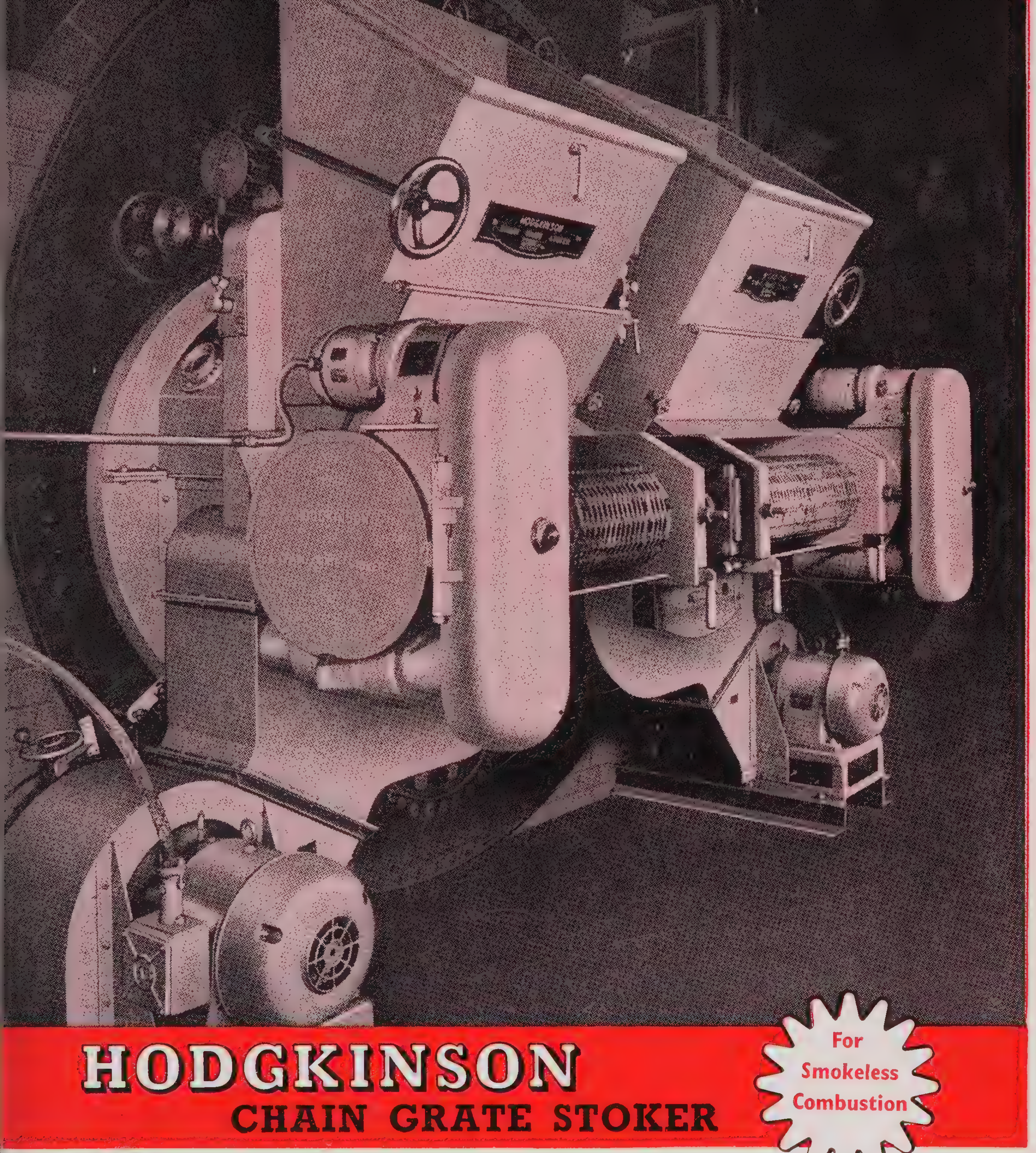

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SMOKELESS AIR

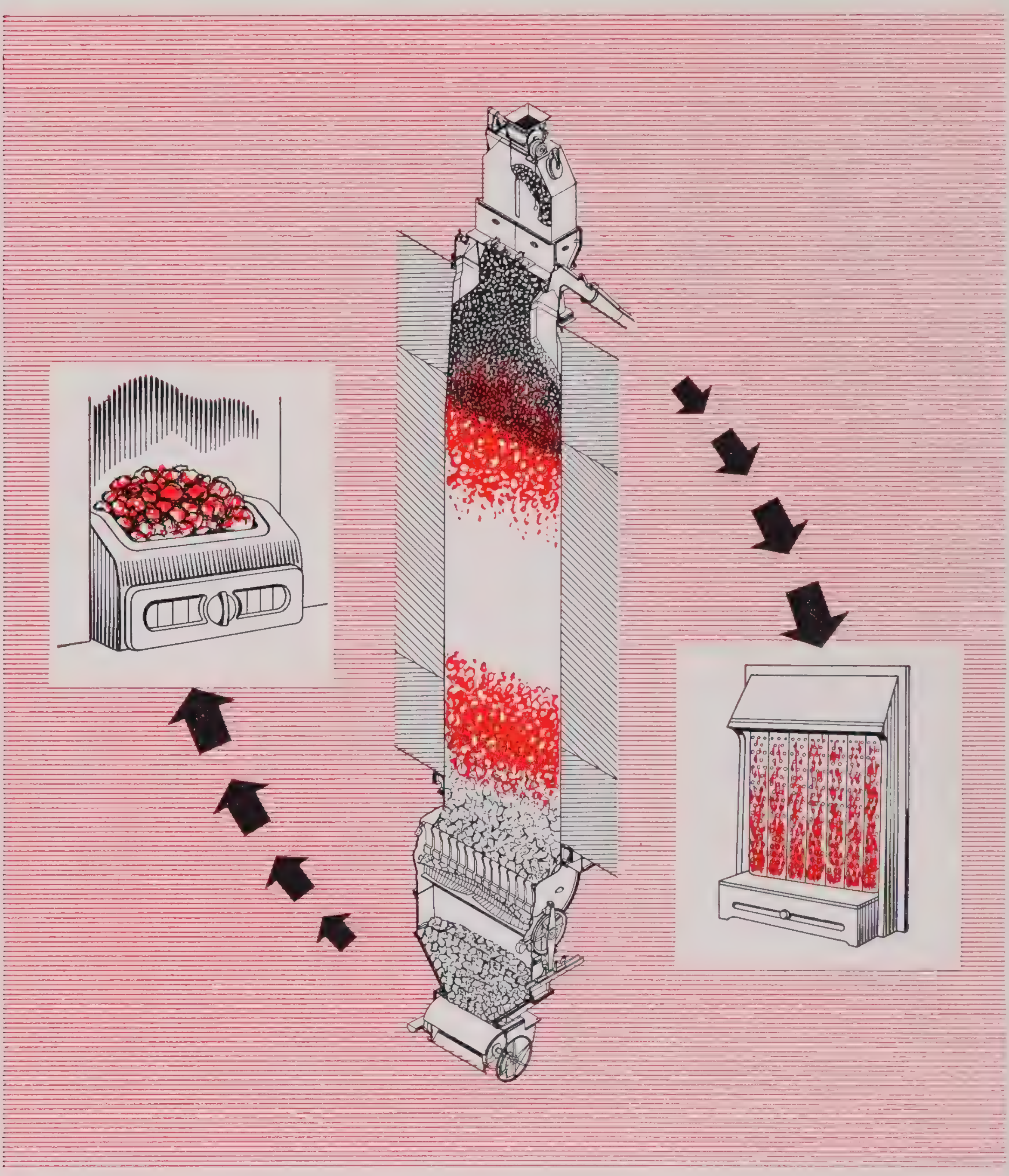
THE SMOKE ABATEMENT JOURNAL

No. 90 SUMMER 1954

ONE SHILLING

In this Issue

Memorandum to the Beaver Committee
Energy for Britain
Smokeless Zone for Bolton
Smoke and the Washing Bill
Towards Clean Air via Smokeless Zones



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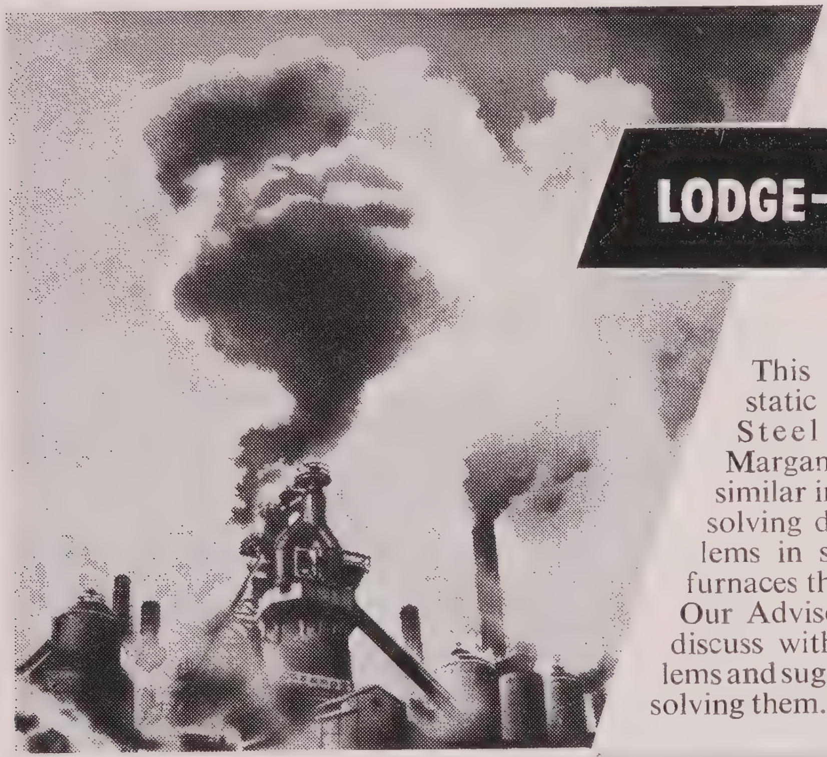

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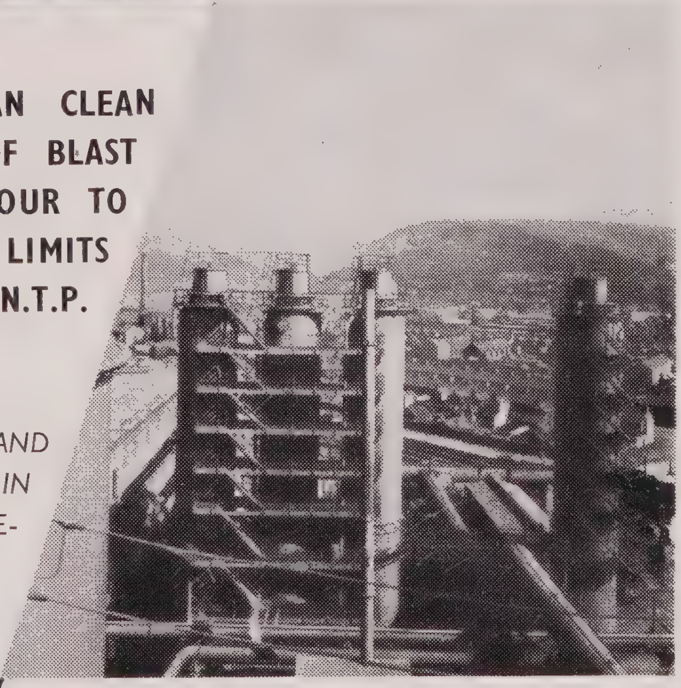

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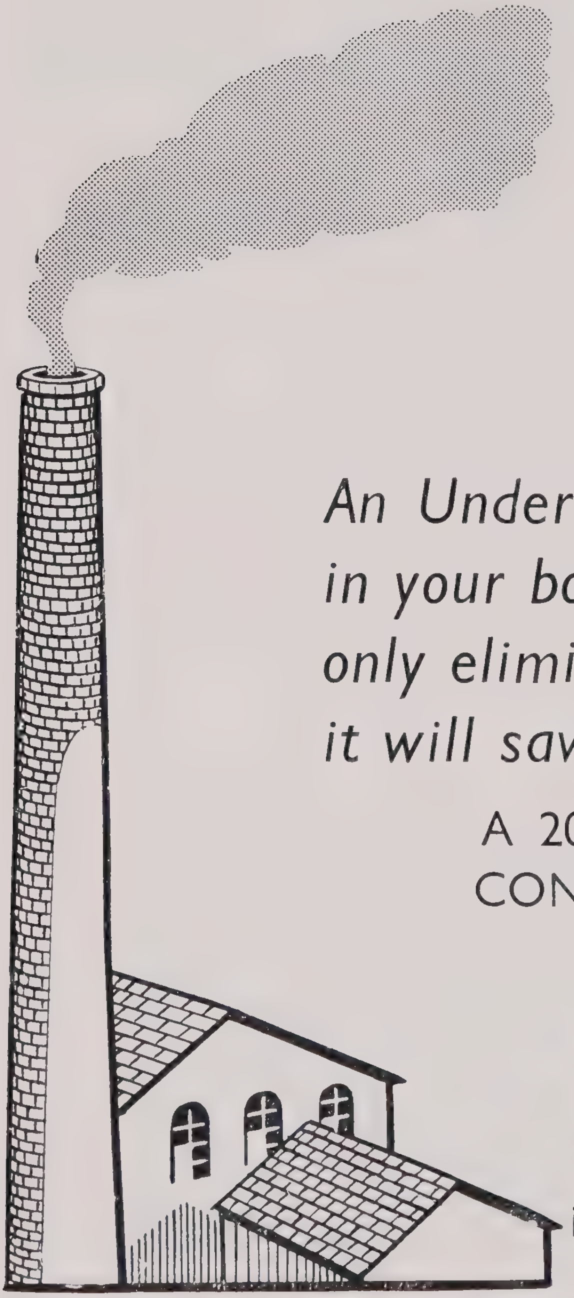

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SOLID SMOKELESS FUELS

The Solid Smokeless Fuels Federation

is a group of organisations responsible for practically the total production of solid smokeless fuels in Great Britain, amounting to 38,500,000 tons per annum. One of the main objects of the Federation is to ensure that solid smokeless fuels are used as efficiently as possible. The combined technical and scientific resources of the Federation, in association with appliance makers, are continually employed in developing high efficiency equipment both for the home and for industry.

The advantages of Solid Smokeless Fuels

Solid smokeless fuels give a *higher* proportion of *radiant* heat than household coal. Consequently you get more useful heat from approved domestic appliances at a *lower* cost for fuel.

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Modern solid smokeless fuel appliances usually incorporate a built-in gas burner or gas poker. Lighting up is therefore simple, clean and convenient. No wood or paper is required.

These fuels are smokeless and sootless. They save dirt and work in the home and help to keep house furnishings and paintwork clean.

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*

Abolish smoke with solid smokeless fuels and get better heating in the home

*

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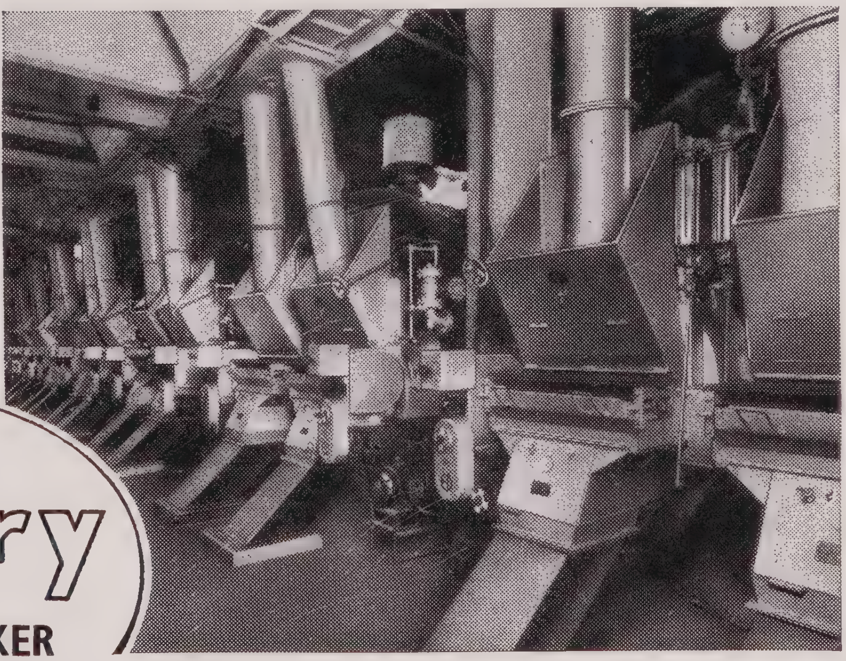

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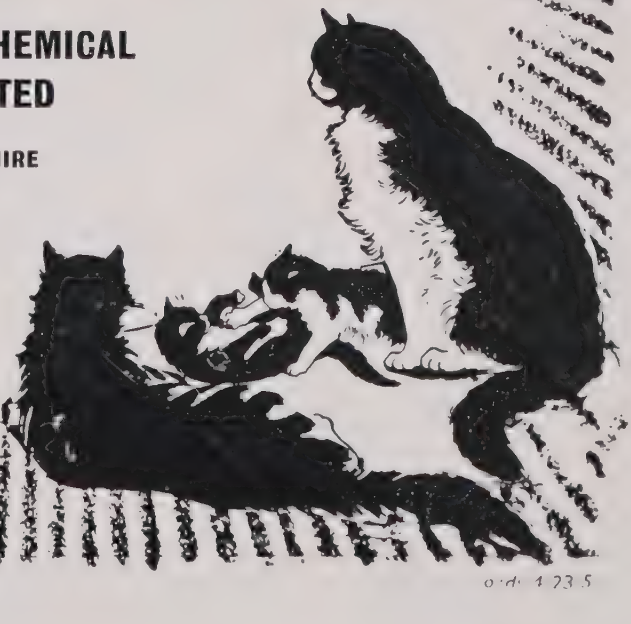

SMOKELESS AIR

Vol XXIV. No. 90 Summer, 1954

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Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

SMOKELESS AIR

Marking Time?

THERE was an impression, a short time ago, that the smoke prevention movement would have to mark time, as it were, until the Beaver Committee had completed and reported on its studies, and that in particular it would be difficult to keep up the propaganda. But it is not turning out like that, as this number will show. The members of the Beaver Committee themselves, by their tour of fact-finding visits to various parts of the country, have created much useful publicity. Then there has been the recent publication of the Society's own memorandum to the Committee, the meeting to set up a Division of the Council in South Wales, further news about smokeless zones to start shortly and many other happenings which are mentioned (if only briefly) in the following pages. In all probability the next event of importance will be the Society's conference at Scarborough in September. Details of the programme are given on another page and it is with particular pleasure that we are able to announce that Sir Hugh Beaver will address the meeting.

Smokeless Zones

Despite an odd rear-guard attack referred to on page 195, the idea of smokeless zones continues to make good progress, and it is gratifying to know that new zones, for Rochdale, Bolton and Salford, will soon come into effect We would not attempt to forecast the findings of the Government Committee, but cannot avoid drawing at least one conclusion from what Sir Hugh Beaver said to a reporter of the *Sheffield Telegraph* when the Committee visited that city: " You have, indeed, a tremendous problem here; but even so I hope this city will establish a smokeless zone. I don't see why you shouldn't. Manchester has done it, and other places are contemplating one, and Sheffield should have one, even though it may be small to start with."

A U.S. Lecturer

The Institution of Mechanical Engineers has notably helped the movement by devoting a James Clayton Paper to the subject of air pollution. The lecturer was Frederick S. Mallette, of the American Society of Mechanical Engineers, and the paper was entitled " A New Frontier: Air Pollution Control." It was delivered to a large audience in London and was later repeated in Manchester and Glasgow. At the London meeting the discussion was opened by the President of the Society, Sir Ernest Smith. The paper reviews the position in the U.S.A. and outlines some of the most successful campaigns for cleaner air—St. Louis, Pittsburgh and Allegheny County, New York City, California and Los Angeles County. Other aspects of the problem are discussed and there is a closer examination of problems of the iron and steel industry. It is hoped to record some of the most important sections of the paper in our next issue, although it is too long for a complete report.

Smog—Last Line of Defence?

We do not normally touch on international questions in these pages, but two recent cuttings, read one after the other, have greatly intrigued us. The first is on the statement in a recent official defence pamphlet (*Fire and the Atom Bomb*, H.M.S.O.) that smog over our cities would filter off most of an atom bomb's flash rays which may start fires and cause severe burns. Fire damage would be greater over a city where the air was free from pollution. Happily, however, there does not seem to be any suggestion that we should keep our smoke just in case that if an atom bomb were dropped it would be dropped on a smoggy day. But if anyone thinks of smog as a defence measure we can point out that Moscow claims to be busy disarming. The second cutting is a report of a Tass (the Soviet News Agency) account of what Moscow is doing to get rid of its smog. A 31-mile belt of trees has been planted round the city to act as a natural air purifying screen, and progress is being made with mechanical stoking, grit arrestors on power stations, a switch to gas in many factories, a device to purify car exhaust fumes and a ban on diesel buses in the centre of the city. Moscow's air, boasts Tass, is becoming cleaner every year, while London's is getting dirtier.

Diesel or Trolleybus?

One point in the Tass story is of interest—the statement that diesel buses are not to run in the centre of Moscow. This comes at a time when controversy rages about the London Transport decision to scrap its trolleybus fleet and replace it by diesel buses. Mr. Gerald Nabarro, M.P., had a long, objecting letter in the *Times* about this, and our own member, Mr. John Fox, criticized it in the *Financial Times*. The amount of pollution caused by diesel-driven vehicles, and what constituents of that pollution may be harmful, does not appear to be known with any certainty, but it is frequently asserted that road pollution may be a factor in the excess of urban over rural lung-cancer incidence. It is now reported that the Public Health Department of the London County Council is to make a full investigation of this matter, and it is hoped that the

Beaver Committee will consider it in detail. There has certainly been a considerable increase in public anxiety during recent years, and this should be allayed as soon as possible. The resolution urging better control over visible emissions from road vehicles through the Road Traffic Act, which was passed at the Society's conference in Glasgow last year was circularized to all local authorities, many of whom have made due representations to their police authorities. We do not know if a recent prosecution for excessive fumes and smoke from a bus in Bristol was in any way a sequel to this resolution.

Smoke Spotters

Salford has invited the co-operation of the public as " smoke spotters " in reporting serious instances of air pollution. There is evidence already, we gather, that the consciousness (and conscience) of the public has been stimulated in this way. Any fear that such complaints might be regarded as a form of snooping has not been borne out in practice—just as it is the citizen's duty to report instances of contaminated food and dirty conditions in cafes and other public places, so it should be considered the duty of the modern citizen to report instances of pollution of the air.

Stokers and Directors

The Director, that stout glossy monthly of the business world, recently published an excellent article on the smoke problem and its cost, and in an editorial note asked: " How many company chairmen know the names of their boilermen? And how many realize that he is the culprit who can waste more power and scatter more smoke than any other employee in a factory? " Well said!—it is something the Society has been trying to put before the heads of business for very many years, although we might add that if the boilerman is a culprit he has an accessory before the act—the chairman. It might even be suggested that not only should boilermen have to be certificated in the use of fuel, but that the directors and managers should be required to pass, perhaps not the same, but some similar examination. Not many years ago we received a booklet on fuel economy in industry, and in an accompanying note the well-known association responsible was rather apologetic about it being so elementary. " It is, however," it was explained, " mainly intended for Boards of Directors."

Meanwhile it is encouraging to note that the City and Guilds of London Institute has an entry of 763 for its first examinations for the new Boiler Operators' Certificate—the new national certificate advocated by the Society, which was described by Mr. Duguid in our Summer, 1953, issue. Two hundred of the entries are from the National Coal Board and 130 from the British Electricity Authority, the rest coming from private industry. This is excellent.

Darkening Valley

Because experience since the war has proved that it is hopeless to try to use the land for growing, a Lea Valley nursery firm has appealed against Middlesex County Council's refusal to allow about 13 acres of glasshouse land to be made over for light industrial use. Speaking at the inquiry, Dr. W. F. Bewley, of Cheshunt Research Station, gave his opinion that for a number of years the area had become increasingly less suitable for growing crops under glass. The reasons were the density of the atmosphere and the restriction of light due to smoke pollution. Greasy soot was deposited on the glasshouses and during the past three years had become an increasing problem due to the proximity of the railway and heavy industrial factories and the greater use of inferior fuel. He added that the firm's figures showed that they were not producing an economic crop in the glasshouses in question.

ENERGY FOR BRITAIN – THE DECADES AHEAD

Excerpts from The Presidential Address to the Institute of Fuel, by Dr. W. Idris Jones

DELIVERING his Presidential Address to the Institute in London on 8th April, Dr. W. Idris Jones, Director-General of Research, National Coal Board, opened with a survey of the relative usage of fuel and energy in the U.S.A. and Great Britain. The U.S.A. used annually for fuel and power the equivalent of 8 tons of coal per person, compared with Britain's 4½ tons and the average for the world of 1½ tons. With only one-fifteenth of the population of the world and one-twentieth of its land area, the U.S.A. consumed one-third of the total world production of fuel and energy.

Coal

In Great Britain we were faced with the problem of finding about 300,000 juveniles and young men in the next 10 to 15 years to help to produce the coal which would be required, on the basis of the predictions made in the Coal Board's Plan for Coal. Improvement in the environmental conditions of underground workers and better organization and technical equipment of the mines were other vital needs. The right attitude to our coal reserves, more of which had been revealed by extensive boring in recent years, was not to spend too much time and energy on calculating how long they would last, but to make the best possible use of the coal we mined. If the need were great enough, ways and means would be found of getting and using vast tonnages of coal which were now considered to be unworkable and unacceptable.

Oil

The demand for oil would continue to increase, and since indigenous oil reserves and production were negligible in comparison with the total consumption, imported oil would continue to be Britain's source of supply. Great progress was being made in oil refining at the main centres in Southampton, Thames Estuary, Firth of Forth, Merseyside and South Wales.

The natural oil reserves of the world were being exhausted with incredible rapidity, and although new sources were constantly being discovered this work involved increasing difficulty and cost, and eventually the time must come when oil supplies would start seriously to decline. One way out was the development of oil-from-coal (hydrogenation or synthesis) processes, but owing to high capital and running costs and costs of coal the outlook in Britain was not hopeful. Research work by the N.C.B. gave promise of enhanced yields of tar oils as a by-product of the thermal treatment of coal for the production of smokeless domestic fuels. As a rough guess, it would appear that the oil requirements of Britain were assured for at least another 100 years.

Electricity

The output of electricity in Britain had increased fourfold during the past 20 years and this trend was likely to continue in the decades ahead. We could look forward to great developments in power generation, with two large grids linking the various divisions of the British Electricity Authority and inter-connecting with the power system of Electricité de France from which substantial supplies of hydro-electric power might be derived in late springtime when the snows melt in France.

Generators with up to 200 MW. unit capacity would be quite common and more than threequarters of the coal fed to power-station boilers would be pulverized fuel. The average efficiency of power generation in the United Kingdom would in a few decades be about 32 per cent. Hydro and tidal power, equivalent to that obtained from about 6 million tons of coal, wind power equivalent perhaps to 1 million tons of coal and nuclear power might make a useful additional contribution to British electricity generating capacity. Increase in power demand would absorb these non-coal sources of energy, and coal would remain just as important in A.D. 2000 as it was today.

District heating and back-pressure operation of thermal stations was likely to play a major part in the heat supply of our towns and cities, and gas turbines would be increasingly employed especially for peak-load supply. Other hopeful lines of development for small-scale use were the heat pump for heating and air conditioning of buildings and for the cooling of ventilation air in coal mines, and the fuel cell whereby it was possible to generate electrical energy direct from coal or its products.

Nuclear Energy

Dr. Jones foresaw great possibilities in the application for fuel purposes of energy derived from nuclear fission. It was now practicable to produce in the fission of the uranium isotope U235 more secondary fuel (plutonium) than is consumed of the primary fuel (U235), and this " breeder " reaction had greatly enhanced the prospects of economic development of nuclear energy. One of the many problems in nuclear power generation was to generate the heat at a sufficiently high temperature to give a reasonable efficiency of conversion to mechanical power. Though there were many technical and economic problems to be solved, it was possible that a reactor system might be set up that within 20 years would generate enough electricity to save 20 million tons of coal annually. Decades would probably pass, however, before a large proportion of this country's electricity could be generated by nuclear reactors. The possible construction by British and American firms of atomic-energy plants for installation in the less technically advanced countries overseas that are devoid of fuel would be welcomed.

Dr. W. Idris Jones

Fuel Utilization in British Industry

In the coal industry since 1949 the number of Lancashire boilers fitted with mechanical stokers had been increased 1.4 times, thus saving about half a million tons of coal a year. In industry generally, there would be in the future close grouping of factories to facilitate centralized heat and steam supply from high-pressure water-tube boilers, while back-pressure generation would be a common feature of future boiler and power plants, frequently providing sufficient electricity for the whole power demand of the factory.

Pulverized-fuel firing would extend enormously, especially in the B.E.A. boiler plants, and the adverse effects of sulphur dioxide might be avoided by discharging the flue gases from very tall power-station chimneys.

To eke out the resources of coking coals required for the production of metallurgical coke, scientific blending of other coals with them would be a general feature of coke-oven operation in the future, and it might be necessary to confine the use of such coals entirely to coke making. Coke for cupolas and blast furnaces might in the future be obtained from low-rank non-caking coals by suitable pretreatment followed by briquetting and carbonization.

There would be further improvement in the efficiency of utilization of fuel in the iron and steel industry; the possibilities in this direction were exemplified by the fact that whereas 66 therms had been required to produce one ton of steel in 1946, with the latest type of open-hearth furnace, in 1953 only 37 therms were needed.

The consumption of coal by the gas industry was 28 million tons in 1953. Likely technical developments included advance in the blending of low-rank coals for carbonization, further improvement in the performance, efficiency and economy of continuous vertical retorts, and the use of oil gas and refinery gases. The output of gas, coke and other smokeless fuels would be increased to meet the requirements of smoke-prevention policy, and total-gasification processes would come to the fore as a means of utilizing the increasing production of low-rank fines.

Methane drainage from coal seams would help to augment town-gas supplies, and there was hope that the drilling programme of the Gas Council now in progress would lead to the discovery of supplies of natural gas in this country.

Dr. Jones concluded his address with a reference to the " shocking inefficiency of much of our fuel-using equipment in the past," and made a plea for more training, adequate technical and scientific knowledge and further research and development work. More people, from directors and managers downwards, must come to realize the vital importance of their becoming conversant with fuel and energy usage. In that field of knowledge the next 50 years would present a great challenge to men of foresight. courage, adaptability and creativeness,

Members of the Beaver Committee surveying Birmingham from the top of a building during their recent tour. Dr. W. R. Martine is pointing out landmarks to Sir Hugh

(photo by courtesy of Birmingham Post & Mail.)

Scarborough Programme

Sir Hugh Beaver to Speak

ARRANGEMENTS for the Society's 21st annual conference at Scarborough on 22nd to 24th September are now complete, and a distinctly forward-looking programme has emerged. As already announced the Des Voeux Memorial Lecture will be by Sir Edward Salisbury, Director of the Royal Botanic Gardens, Kew, and Secretary of the Royal Society, on " Air Pollution and Plant Life." Now, Sir Hugh Beaver, Chairman of the Government Committee on Air Pollution, has accepted an invitation to attend and to address the conference on the Wednesday afternoon—following the official opening of the meetings by the Mayor of Scarborough and the Presidential Address by Sir Ernest Smith on the morning of that day. The discussion on Sir Hugh's address will be opened by Dame Vera Laughton Mathews, Past-President, followed by Dr. W. R. Martine, Chairman of the Executive Council.

Sir Edward Salisbury, Sec. R.S.

On the Thursday morning there will be a paper by Mr. R. F. Harvey, Chief Officer, Motive Power, British Railways, on developments promoting smokeless railway locomotion; after which, in a neighbouring cinema, there will be a film show. This will include the presentation of the new Gas Council film, " Guilty Chimneys," which is described elsewhere in this issue. In the afternoon, looking forward again, there will be papers on developments in the industrial uses of gas and electricity. Gas will be dealt with by Mr. R. F. Hayman, Industrial Gas Officer of the Gas Council, and electricity by Mr. Bernard, Chief Technical Officer of the British Electrical Development Association. An important feature of this session is that the chairman will be Dr. W. A. Macfarlane, Director of the new Industrial Fuel Efficiency Service Company. Since Dr. Macfarlane is largely concerned with solid fuel he and the two speakers will together represent a very broad field, and it is hoped that he will take the opportunity to say something of the activities and aims of his young organization.

On the Thursday evening members and delegates will be invited to a Civic reception by the Mayor and Corporation of Scarborough. On the last morning of the conference, Friday the 24th, there will be the Des Voeux Memorial Lecture by Sir Edward Salisbury, followed by the annual general meeting. The conference will end at lunch time, and the only thing that is regretted is that it has not been found practicable to arrange an instructional tour or visit in the afternoon. Scarborough, however, provides many opportunities for pleasure outings for those fortunate enough to be able to stay on.

Smokeless Zone for Bolton

From November Next

THE County Borough of Bolton has made an Order, which has been confirmed by the Minister of Housing and Local Government, designating an area in the town centre of approximately 86 acres as a smokeless zone. The Order will come into force on 1st November, 1954. This will be the fourth* smokeless zone to be established, and we are confident (the editorial "we" hiding a good Lancastrian) that the people of Bolton will make certain that it is a complete success.

The Order is made under Section 43 of the Bolton Corporation Act, 1949, the provisions of which are similar to those in other smokeless zone clauses—the occupier of any premises from which smoke is emitted in contravention of the Order will be liable to a penalty of £10 and to a daily penalty of £5. It will be a defence to prove that the smoke arose solely from the consumption of coke, anthracite or any other fuel of a type specified by the Corporation and used in a furnace, stove or other appliance which is suitable for burning such fuel and is properly maintained and used.

The diverse types of premises in the area are shown by the following summary, from a report of the Medical Officer of Health, Dr. Ronald W. Elliott:

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* The third smokeless zone will be at Rochdale—see page 192.

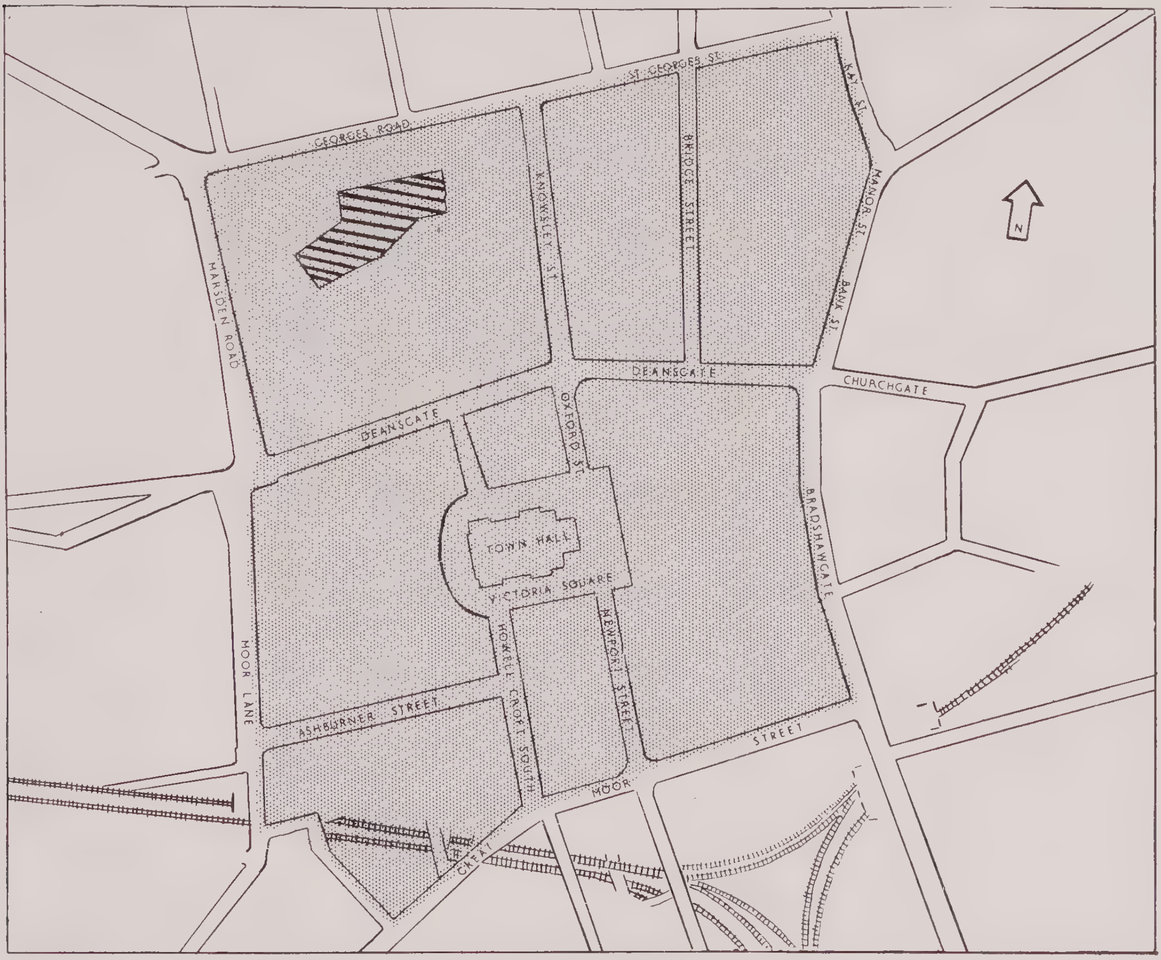
Number of premises	1,050
Residential only	162
Business only (office type) ..	242
Business only (shop type) ..	419
Residential and business combined	63
Industrial and manufacturing	76
Other (churches, theatres, etc.)	88

An analysis of the appliances now in use and of the fuels used shows that 45 per cent. of the premises are already entirely smokeless, and that 40 per cent. of the solid fuel used is smokeless.

Among the industrial and manufacturing premises are included a cotton mill, a brass foundry, a constructional engineering works, a general engineering works, a cutlery manufacturers, an oil blending works and a paint manufacturing factory. Two other premises, i.e., a tannery and a steel foundry, have been exempted from the provisions of the Order, but in the latter case only smokeless fuels are used and the emission of vapours from some of the processes is said to be unavoidable. In the case of the tannery, mechanical stokers of a type capable of being operated smokelessly have been installed and the plant has been approved by the Council on the recommendations of its Prior Approval Panel.

In addition to the formation of the smokeless zone, there are special legal powers regarding the prevention of smoke by prior approval of new installations or improvements in boiler house plants. When information is received regarding such proposals, the Health Department informs the manufacturers and industrialists that the proposed installation should be submitted to the Corporation for approval

—*concluded on next page*



The central area of Bolton, with the smokeless zone shaded. The exempted premises are hatched

The Society in South Wales

For some time members of the Society in South Wales have been urging the Society to promote some organization in that area, and accordingly on 6th May a successful meeting to discuss this was held in the City Hall, Cardiff. Over 80 members and delegates were present, including representatives of 30 local authorities and 22 industrial, fuel and technical firms and associations.

At the morning session, Sir Ernest Smith, President, was in the chair. Mr. Arnold Marsh, Director, spoke on the present situation in smoke prevention, and Mr. F. J. Redstone, speaking as a Deputy Chairman of the Executive Council and as Hon. Secretary of the Bristol and District Regional Smoke Abatement Committee, dealt with the special question of area organization. He explained the function and membership of the Society's Divisional Councils and the advisory committees of local authorities.

At the afternoon session the Chairman was Dr. W. E. Thomas, Medical Officer of Health of the Glamorgan County Council, and the discussion was centred on the position in South Wales and the value of an organization for the area. The opening speakers were Mr. G. A. Morgan of Port Talbot and Mr. Ieuan Lewis of Pontardawe R.D.C. They were followed by other speakers and at an early stage it was clear that the meeting was anxious for a Divisional Council of the Society to be set up in the area.

It was explained that at present South Wales was a part of the Society's South West Division and that it would require an amendment to the constitution to create a separate Division. This, however, had already been considered by the Executive Council, which had agreed, if a South Wales Council was desired, to submit an appropriate resolution at the Annual General Meeting to be held in September.

A number of the local authority representatives present felt that they could not vote to set up an *ad hoc* organization or provisional committee until they had reported to their Councils and obtained a mandate to do so. Accordingly a resolution was passed, *nem. con.*, recommending that a Divisional Council be established, that this be submitted to all members in the area, and that head office be asked to convene a further meeting in due course formally to bring the Council into being and to elect a provisional committee and Honorary Secretary for the purpose of preparing a constitution.

Smokeless Zone for Bolton — *concluded*

by a special Panel which has been set up for this purpose. The Panel comprises a consultant engineer on boiler house practice, the regional engineer of the Ministry of Fuel and Power, an engineer nominated by local industry, the Borough Engineer, the Medical Officer of Health and the Chief Sanitary Inspector. A Code of Requirements has been drawn up by the Panel and states in general terms the circumstances in which proposals will be approved.

The Medical Officer's report concludes: "It is expected that these measures will secure an eventual transition to comparatively smokeless conditions in Bolton. Given the co-operation of the public, the success of this first smokeless zone should, in due course, enable further zones to be designated as smokeless by the same procedure."

MEMORANDUM

to the

BEAVER COMMITTEE

We reprint, for the information of members, the Memorandum submitted on behalf of the Executive Council to the Committee on Air Pollution.

I. INTRODUCTORY

1. The National Smoke Abatement Society is a voluntary association formed in 1929 by the amalgamation of the Coal Smoke Abatement Society (1899), which was concerned mainly with London, and the provincial Smoke Abatement League of Great Britain (1909). The membership of the Society consists of individuals, commercial firms, technical and professional associations, the national fuel, power and transport industries, and over 450 local authorities. The Society, which is the only body of its kind, has a headquarters office in London and Divisional Councils for Scotland, the North East, North West, Yorkshire, West Midlands, East Midlands and South East. Over the years the standing and influence of the Society have steadily grown, and today it is recognized as the centre for the study and discussion of questions and ideas, and for information, publications and publicity services. The Society's Year Book, gives full details of the membership of the Executive Council, subscribers, and recent activities, etc. The Society's present position is referred to further in paragraph 39 below.

2. Because of the many interests and points of view it represents, and its considerable experience in the field of air pollution, the Society is well qualified to submit the observations and proposals that follow. It should be mentioned that all members of the Society were invited to give their own views on the nature of the Society's submissions to the Committee of Inquiry, and a considerable number have done so. Their replies, although varying individually in form and detail, are substantially in close agreement with this memorandum. The knowledge that the views of the Executive Council, as given below, are so similar to those of the Society's members generally increases the confidence with which they are submitted.

3. The present Memorandum should be regarded only as a general statement of the principles on which we believe action should be taken. To have discussed each of our proposals in close detail, without knowledge of those on which the Committee might or might not desire additional information, would have considerably and perhaps unnecessarily lengthened and delayed the present Memorandum, but we hope that the Committee will ask us for additional information on any of the matters outlined below. As a result of the preliminary informal discussion we have been privileged to have with the Committee, certain additional memoranda on specific questions are under consideration, *i.e.*, on the administration of the present law, the training of stokers, and research.

4. The Interim Report of the Committee has been studied with appreciation, and it is recognized that it is not necessary to review at length the consequences of air pollution, which have been so well noted. The injury to health, the heavy economic costs and the wastage of fuel involved are the three principal factors, and in our opinion any one of these taken entirely alone would fully justify the proposals that follow. Taken together, the case for prompt, urgent and high-priority action on the lines proposed is unquestionable, and we believe that the annual cost of abolishing pollution, even with the most vigorous programme, would not be likely to be more than a fraction of the annual cost of continuing to fail to take effective action.

II. SOURCES, CAUSES AND NATURE OF POLLUTION

5. We consider that further investigations into certain aspects of the sources, causes, nature and action of air pollution are desirable. The problem is, however, less simple than might at first sight appear likely, both because of the intermingling of the pollution from different sources, and the effect of different constituents acting in association. On the health aspects, for instance, smoke particles and the sulphur oxide gases may act synergistically,[1] and similarly the corrosion of metals and erosion of stonework is increased by sulphur gases and tarry-solid deposits in association.[2] Further scientific investigation should not therefore be allowed to delay measures to prevent or reduce the emission of each and all the separate constituents that enter into the pollution " complex." Discussion, for example, of the relative culpability of sulphur gases and visible smoke, or of factory and domestic emissions, is in our view of little value. The statements and proposals that follow are based on the view that drastic action is necessary and that it should be directed to the fullest possible extent against all the major constituents of pollution and all contributory sources.

III. PROPOSALS FOR ACTION

6. It is considered that these for convenience may be divided into (*a*) action not requiring new legislation, which should be undertaken by the central Government, local authorities, industry, trade unions and others ; (*b*) new legislation required ; and (*c*) the education of public opinion.

7. The usual division of such proposals into " short term " and " long term " is useful, but in this case there are few specifically short term remedies, except in so far as they are the initial stages of the comprehensive long term policy required. The problem calls for the continuous development of such a policy over a period of years.

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[1] See *Chemical and Engineering News* (U.S.A.), 29 June, 1953, quoted by Dr. J. A. Scott, in a report on the London Fog Disaster, N.S.A.S. Glasgow Conference, October, 1953 ; Federal Security Agency, Washington, Report on the Donora Smog Episode, 1948 (p. 162) ; Epidemiology and Social Significance of Atmospheric Smoke Pollution, by McDonald, Drinker and Gordon, *J.Am.Med.Sci.*, March, 1951, 325-342.

[2] See Vernon, *Chemistry and Industry*, 21 August, 1943 ; Schaffer, *The Weathering of Natural Building Stones*, Building Research Station Special Report No. 18, D.S.I.R., 1932, etc.

IV. ACTION NOT REQUIRING LEGISLATION

ACTION BY THE CENTRAL GOVERNMENT

(i) *Fuel Policy*

8. In all the post-war reports on fuel utilization (the Egerton, Simon and Ridley Reports and the Productivity Council Report on Fuel Conservation) the importance of smoke abatement has been fully recognized, but it is clear that there is a wide gulf between the recognition of the problem and the adoption of the measures needed to resolve it. In matters of national fuel policy it appears that smoke abatement has been recognized either as useful because it will assist fuel economy, or as an incidental benefit from measures proposed primarily for other purposes.

9. We believe that the case for smoke prevention is of such importance that it is necessary for the problem to be dealt with in its own right and at the highest levels of priority in all questions of fuel utilization and development. In other words smoke prevention should be included among the first factors to be considered, and that the measures that are needed should be developed urgently and systematically until they are complete. Conversely, fuel policies, developments and propaganda that are not in the interests of smoke prevention should not be countenanced. (*E.g.*, propaganda for the overnight use of bituminous slacks in domestic appliances.)

10. On the industrial aspects of fuel policy it is suggested that many of the recommendations of the Ridley Committee and of the Productivity Team on Fuel Conservation should be implemented, with greater weight given to their value to smoke prevention. We wish to emphasize the importance, with respect to the prevention of air pollution, of coal preparation and quality on the one hand, and the equal importance of its efficient usage on the other. Among the factors promoting the prevention of pollution are :

(i) The cleaning of coal for the reduction of grit and sulphur dioxide emission.
(ii) Appropriate qualities of coal for different types of plant.
(iii) Consistency in the quality supplied.
(iv) The better training and status of stokers.
(v) Efficient management, instrumentation and maintenance of existing plant.
(vi) Acceleration in the rate of modernizing fuel-burning plant.

Loans for new fuel-burning plant should be granted not only for the promotion of fuel economy but also for the prevention of air pollution, including smoke, grit and noxious gases. The new National Industrial Fuel Efficiency Service should similarly be required to assist in solving air pollution as well as fuel efficiency problems.

11. Both in industry and for domestic purposes the use of gas and electricity should be promoted for purposes that further the abatement of air pollution, and this factor should be taken into account in matters of policy relating to the development of these mediums. Similarly, although the extent to which district heating may be developed cannot depend primarily on the contribution it would make towards smokeless air, this should be taken into full account in favour of district heating proposals.

12. On the domestic aspects of fuel policy we recognize and accept the need for solid fuel to take the main winter heating load. It is this load, mainly from open coal-burning fires (of both obsolete and modern types) that is the principal factor in the problem of domestic pollution. The smokeless combustion of raw coal in domestic grates and openable stoves appears to be unlikely, and if domestic smoke is to be abolished it must be by the replacement of raw coal with solid smokeless fuel. It is not possible to discuss the question in detail, but in so far as it concerns national fuel policy the main points may be summarized as follows :

(1) The quantity of solid smokeless fuel suitable and available for domestic use should be progressively increased by (*a*) increased carbonization by all available methods ; (*b*) liberation for the domestic market of suitable solid smokeless fuel at present being used in industrial and semi-industrial installations, where these could be modified so as to burn alternative smokeless fuels or bituminous coal (with virtually no smoke) in modern mechanically-stoked furnaces. The attention of the Committee is requested to the paper by Buist, Cooke, David and Prosser at the Glasgow 1953 Conference of the National Smoke Abatement Society, in which it was shown that 37 million tons of smokeless fuel are produced annually in Great Britain, of which only 5 million tons are used domestically, and that it should be possible to make available for domestic purposes 10 million tons by 1957 and 15 million tons by 1962, partly by planned increases in production and partly by withdrawals from other markets. (*c*) Extension of research (of the kind now being conducted by the National Coal Board) for the development of new processes for the production of solid smokeless fuel, in briquetted or other forms, from coals other than those now used for carbonization.

(2) The available supplies of solid smokeless fuels should be used preferentially in selected areas that will benefit most from their use, as for example in smokeless zones. In the paper mentioned above it is estimated that at present 13 million tons of bituminous coal are at present being consumed annually for domestic purposes in the areas of heavy smoke pollution. Presupposing that 2 million tons of this can be economically replaced by gas or electricity for summer water and space heating, and taking into account the higher efficiency of smokeless fuel in modern appliances, 7 or 8 million tons of smokeless fuel would be required to eliminate domestic smoke from the " black " or " smog prone " areas. To provide this, we suggest, should be the first obligation of the smoke prevention programme we are anxious to see adopted.

(3) More attention should be given to the quality and price of solid smokeless fuel, and to the need for education to overcome the habits of raw coal usage. The raw coal tradition is so deep that the benefits of using smokeless fuel must be made evident, especially if smokeless zones in one form or another are to be imposed. Bearing in mind the heavy social cost of smoke there is a strong case for incentives

(including that of quality) to popularize its use in place of raw coal.

(4) We strongly support the recommendations of the Ridley Committee for encouraging the installation of solid fuel burning domestic appliances of high standard of performance, and further would urge that in smokeless zones and other selected areas the cost of their installation should, if necessary, be borne by subsidy from the central Government, provided always that the use of solid smokeless fuel only is ensured.

(5) Further, the installation of domestic appliances using gas or electricity should be encouraged by the abolition of purchase tax, by freedom from hire purchase restrictions, and by making it possible for them to be recognized as tenants' fixtures.

(6) We also support the Ridley Committee recommendation on the insulation of houses, which by reducing fuel consumption will either reduce smoke (where coal is still used) or make smokeless fuel available for a larger number of consumers.

(7) The manufacture and sale of domestic appliances of low standard, or not suitable for solid smokeless fuels, should be halted either by some form of prohibition or, if this is not technically practicable, by a purchase or other excise tax that will bring their selling price above that of the cheapest of approved appliances. It should be made as difficult to purchase such appliances as it is to purchase dangerous drugs.

(ii) *Research*

13. Further research, or the encouragement and financial support for research by industry, on outstanding pollution problems is necessary, and should be initiated by the Government. Among the problems are those of the removal of sulphur oxides and of grit and dust from flue gases ; those arising in the iron and steel industries, the clay industries, coke ovens, cement manufacture and lime-burning ; chemical pollutants ; road vehicle exhausts ; and on the further development of solid smokeless fuels and of domestic appliances.

14. Further, as in other fields, it is necessary to ensure that the results of research are at once made generally known, and that their application, with as little delay as possible, is promoted. The importance of this is demonstrated by the remarkable differences to be found, in respect of air pollution, between the best and worst installations in many industries.

(iii) *Encouragement of Local Authorities*

15. In our opinion and that of many of the Local Authority members of the Society the central Government has frequently failed to encourage or facilitate proposals by Local Authorities for the prevention of air pollution. The difficulties in recent years of Local Authorities obtaining byelaws under Section 104 of the Public Health Act, 1936, may be instanced.[1] We consider that the central Government should not only be more ready to approve initiative by Local Authorities but that it should in fact stimulate it.

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[1] An instance was given in a paper by W. Parker to the West Midlands Joint Advisory Council for the Abatement of Smoke and Atmospheric Pollution, 26 Feb., 1953. See *Smokeless Air*, Autumn, 1953, 28-30.

(iv) *Publicity and Information*

16. For reasons stated more fully in Section VII of this Memorandum, the Government should give financial aid for the development of the publicity and information services necessary to educate public opinion.

(v) *New Legislation*

17. The Government should initiate as soon as possible the necessary study of the new legislation required, as proposed in Section (v), p. 6.

(vi) *Standing Committee*

18. The suggestions made above (paragraphs 13-22) and many other matters that will arise when a vigorous clean air policy is adopted, and which will concern a number of Government departments, call for administrative arrangements (such as a standing committee for air pollution) to keep the problem under continuous review. These arrangements might be a responsibility of the Lord President of the Council, who is the Minister in control of the Department of Scientific and Industrial Research. If such a Committee is set up or other arrangements made the National Smoke Abatement Society will be prepared to co-operate in any way that may be desired.

ACTION BY LOCAL AUTHORITIES

19. Under the existing law smoke abatement is the responsibility of local authorities and in this and other ways, for which local action is needed, they can accomplish a great deal towards the abatement of air pollution. Many authorities are already active, but in other cases there is very little interest shown in the problem. It is therefore suggested that local authorities be urged to concern themselves more closely with the problem, in ways which include the following :

(i) *Legal Powers*

20. As suggested on p. 5 (paragraph 15) local authorities should use to the full their existing powers for the abatement of industrial smoke, although this should be backed by a full technical understanding of, and a constructive approach to, the difficulties encountered, and fully qualified smoke inspectors should be employed.

(ii) *Investigation of Air Pollution*

21. Although the number of authorities co-operating under the scheme co-ordinated by the Fuel Research Station in the investigation of air pollution is increasing, it is desirable that observations should be made in many other areas ; while local authorities already co-operating might, in some cases, increase the number of observations being made.

22. It is, however, considered that in the case of smaller authorities deterred by the cost of instruments and of the periodical analyses required, arrangements should be made for financial assistance from the central Government or County Council. Standardized fees for analyses should be promoted.

(iii) *Encouragement of Smokeless Methods*

23. Apart from planning and other legal powers, local authorities should, by persuasion and education, promote the adoption of smokeless methods in houses, commercial premises, office and industry, and special efforts should be made in respect of central and other areas of heavy pollution. Although the problem is primarily the concern of the Public Health Departments, steps should be taken to enlist the more active interest and collaboration of other departments, especially those of the Surveyor, Engineer and Architect.

(iv) *Education and Publicity*

24. Health education is a statutory activity of local authorities, and this should, to a much greater extent than at present, include smoke abatement education and propaganda, both direct and through local organizations, including women's organizations and schools. They should also give greater support to the national campaign that the National Smoke Abatement Society, with at present most inadequate resources, is attempting to develop. Such developments will among other things make possible the greater provision by the Society of publicity material and services for local authority use.

(v) *Planning Powers*

25. Through the exercise of their planning powers and by consultation, local authorities may prevent, or at least control, new sources of pollution from coming into existence.

(vi) *Consultative Committees*

26. During the last few years a number of local authorities have set up local consultative committees consisting of representatives of the authority, industry and commerce, the fuel and power industries, trade unions and other bodies. These can be of considerable value in dealing with existing problems, planning the avoidance of new pollution, and for educational purposes. In our opinion the establishment of such committees is worthy of consideration in other areas.

ACTION BY INDUSTRY

27. We believe that a great deal of pollution from industrial sources could be prevented by the greater interest, co-operation and pooling of knowledge in industry itself. In particular may be mentioned the following :

(i) By the attention of individual firms to their own problems, encouraged and assisted by Trade Associations, Chambers of Commerce, etc. In many cases it may be necessary for the initiative to be taken by the latter bodies.

(ii) Closer co-ordination of smoke prevention with fuel efficiency measures should be taken through, or promoted by, the new National Industrial Fuel Efficiency Service, the Ministry of Fuel and Power, etc.

(iii) Trade Associations or groups of firms should start, or extend, research and the field study of their specific problems.

(iv) A few undertakings are already co-operating in the investigation of air pollution by maintaining their own measuring instruments. This could be considerably extended.

(v) Industry should participate in, or promote, schemes for the training and qualification of stokers, agree to employ qualified men, and improve their status.

(vi) As is already being done to a small extent in this country, and more widely in the U.S.A.,[1] industry should support the campaign for publicity and education. It should be stressed that a large proportion of the social cost of smoke is borne directly by industry and commerce.

ACTION BY TRADE UNIONS

28. We feel that Trade Unions should co-operate more closely with activities for the prevention of air pollution, both because of the benefits it will bring to all their members and their families, in towns and industrial areas, and because many of their members can assist directly in the technical sense. We suggest that the Trade Unions should :

(i) Co-operate further in schemes for the training and qualification of stokers and assist in popularizing such training.

(ii) Support the campaign for publicity and education, both generally and through union branches.

V. NEW LEGISLATION

29. The basis of the general smoke abatement legislation in England and Wales is the smoke nuisances section of the Public Health Act, 1875, as amended by the Public Health (Smoke Abatement) Act, 1926, and now included in the consolidating Public Health Act, 1936, and Public Health (London) Act, 1936. The 1926 Act strengthened the 1875 Act in several respects, but only one of these improvements has been of any value in practice—namely, the power, if a byelaw is sought for and confirmed, to declare the emission of black smoke for a stated period of time to constitute a nuisance. In effect, therefore, the legislation has changed scarcely at all during the past three quarters of a century.

30. The existing law may be criticized on the following grounds :

(i) It deals only with action that may be taken after a " nuisance " has been committed, and does nothing to prevent nuisances from arising. The approach to the problem is therefore wholly negative (or what has been called stable-door control).

(ii) It is limited to smoke from industrial sources and includes no provisions for the abatement of domestic smoke.

(iii) The principal section (101), which defines statutory smoke nuisances, is, as far as we are aware, infrequently used because of (*a*) the difficulty in law arising from the " best practicable means " proviso, and (*b*) the difficulty of proof of nuisance.

(iv) Section 104(1) permits a local authority to make byelaws regulating the emission of smoke " of such colour, density or content as may be prescribed," but it has proved impossible for local authorities to obtain from the Minister confirmation of byelaws other than for *black* smoke.

(v) Section 104(2) permits the inclusion in building byelaws of the provision in new buildings, other than private houses, " of such arrangements for heating or cooking as are calculated to prevent or reduce the emission of smoke." Efforts were made, after the passing of the 1926 Act, to obtain a form of byelaw for this purpose that would receive the approval of the Minister, but without success, and this sub-section also remains inoperative.

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[1] See article by Charles F. Gruber, Chief Smoke Inspector, City of Cincinnati, in *Smokeless Air*, Winter, 1953, 74-76.

(vi) The 1875 Act listed a number of industrial processes against which action under the Act could not be taken if it interfered with or obstructed them. In practice this proviso virtually exempted such processes from control. It was retained, with provisional additions, in the 1926 Act, despite local authority objection. Power is given to the Minister to remove any process from the list or to add others, and an assurance was given during debate on the Bill that a review would be made at the end of five years. No change has, however, been made during the 27 years that have passed since the Act came into force, and in our opinion, and that of the local authorities most closely concerned, this section is no longer necessary and seriously obstructs both the due administration of the law and the development and application of improved techniques that will prevent or reduce pollution.

(vii) There is no obligation on local authorities to obtain byelaws under Section 104, and many have not done so. Further, since 1945 the Minister concerned has either refused to confirm applications or has sought to dissuade local authorities from making them.

31. For these reasons, and bearing in mind improved principles of air pollution legislation included in a few recent local Acts of Parliament in this country and more generally in other countries (principally the U.S.A.), we are of the opinion that the present general legislation requires such amendment and extension that the only practicable course is to repeal it in its entirety and to replace it by a new and comprehensive measure.

32. The new legislation should include provisions of which the broad principles may be summarized as follows :

(i) Power for local authorities, or joint committees of local authorities, to take action, and for penalties to be imposed on all chimney emissions, except from private dwellings, that exceed standards to be prescribed. Byelaw procedure should not be required and there should be no " exempted " processes.

(ii) The plans and specifications of all new fuel-burning installations, other than domestic, and all substantial alterations to existing installations, to be submitted to the local authority, or joint committees of local authorities, for prior approval, and the installation to be certified before operation ; except in cases where approval procedure by other means is acceptable. Where necessary approval should be dependent on the nature of the fuels to be used and where desirable there should be provision for inspection. (See Appendices for notes on U.S. legislation and on Prior Approval).

(iii) Powers to establish areas in which smoke is prohibited, similar to the provisions included in the Model Clauses Handbook, 1953. (See also Appendix on Smokeless Zones).

(iv) All local authorities to be required either to employ fully qualified smoke inspectors according to requirements to be prescribed, or to combine with other local authorities in Joint Air Pollution Control Committees employing such inspectors. In the event of neither of these alternatives being adopted the duties to be carried out by the County Council.

(v) To require all boiler and furnace firemen to possess a certificate of proficiency to be granted on passing an approved examination or (for the time being) on grounds of experience.

(vi) Prohibition of the installation in any dwellings, offices, hotels and commercial premises of solid fuel burning appliances for room heating, cooking and hot water supply that cannot burn satisfactorily some type of solid smokeless fuel.

33. *Scotland.*—In Scotland there are laws dating back to 1857, 1892 and 1897. The Public Health (Scotland) Act, 1897, is that most generally used. It is similar in many respects to the Public Health Act, 1875, for England and Wales, but as in other Scottish Acts the phrase " black smoke " is not used. Smoke of any colour in such quantity as to be a nuisance or injurious or dangerous to health is an offence. There are also local Acts. The criticisms made above of the law for England and Wales can be applied also to the Scottish law, and it is suggested that the new legislation proposed should apply also to Scotland, or that a similar Act for Scotland should be adopted at the same time.

VI. ADDITIONAL PROBLEMS

34. The preceding sections of this Memorandum have reference to what may be termed the general problem of air pollution arising from the domestic and industrial combustion of fuel. There still remain specific problems to which attention should be given by the Committee of Inquiry. To discuss these in detail would considerably lengthen this Memorandum, and they are therefore for the present mentioned only summarily, as follows :

(i) Sulphur oxides emission from large-scale plant. The seriousness of this problem has no doubt been recognized by the Committee of Inquiry, and we would emphasize that although for convenience it is listed here with a number of other problems, it is in our view in a special category of importance, and its further study should be given highest priority.

(ii) (*a*) Road vehicle exhausts from both petrol and diesel-driven vehicles.

(*b*) Pollution from road heaters during repair operations.

(iii) Locomotive smoke, particularly that arising from engine sheds and in shunting operations, and including smoke from industrial works locomotives.

(iv) Smoke and fumes from coal carbonization plant, and coke ovens in particular.

(v) The special domestic smoke problem arising from the concessionary allocation of coal to miners.

(vi) Pollution arising from the burning of waste industrial materials.

(vii) The problem of burning colliery spoilbanks.

(viii) Industrial processes that are controlled under the Alkali, etc. Works Act, and especially those arising from cement manufacture, lime-burning, sulphuric acid and other chemical works, and the newer textile manufacturing processes.

VII. THE EDUCATION OF PUBLIC OPINION

35. An informed and interested public opinion is needed to encourage or impel the action required for the prevention of air pollution, and to ensure the acceptance of, and willing co-operation in, the measures that are called for. From the nature of the case it is difficult to bring the problem clearly before the general public, which is habituated to polluted air and a dirty environment.

36. The view of the Newton Committee in 1920 that " no Government has, for many years, taken any action with the exception of appointing committees, whose labours have had little or no result," was of course confirmed by the failure of its own report to achieve material results. While this may again be attributed to lack of interest and concern of the Government, the underlying reason was undoubtedly the absence of the stimulus of public opinion, without which Government action cannot be expected.

37. The suggestions made in this Memorandum are largely dependent for their implementation on public opinion and public demand. Without such approval and even pressure, both popular and among those directly responsible for taking or initiating action, such proposals will continue to remain unfulfilled.

38. So far it has been possible only to touch the fringes of the publicity and educational work that is required. The National Smoke Abatement Society has been attempting to do this for many years and—considering its extremely limited and uncertain resources—has achieved a certain amount of progress. It has, through its initiative and persistence, gained considerable practical experience in this field of propaganda, and is anxious to be given the opportunity for development.

39. The growth of interest in the prevention of air pollution in recent years (one indication of which is a five-fold increase in the number of Press cuttings received by the Society over the past seven years), which in part at least may be attributed to the Society's efforts. The London fog disaster of December, 1952, has of course sharply increased this interest, even though the reactions to this event may only be temporary. One consequence of this growing interest is the demands on the Society for information and services of various kinds, but with which, without more staff and facilities, it is becoming more and more difficult to cope. The Society has come to be recognized as the national centre for all general intelligence on air pollution, advice, complaints, publicity material, publications, lecture services, and so on.[1] This work, carried out from the headquarters in London and by the Divisional Councils in the provinces, is at present being conducted on an income of about £5,000 a year. This means that only a small fraction of the work which the Society wishes to undertake (and which is now expected or demanded from it) can even be begun.

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[1] As an example of the work that can be done by the Society, and of the attention that it receives from local authorities and others, may be mentioned the sale, during the last two months, of some 25,000 copies of two pamphlets of excerpts, relating to smoke prevention, from the Ridley Report on National Fuel Policy.

40. We wish therefore to take this opportunity of suggesting that the Committee should consider the difficulties of the Society's position due to shortage of income restricting the appointment of staff and essential office accommodation. It would be helpful if the Committee could see its way to recommend that the work of the Society is worthy of financial support from the Government.

41. The Society is anxious that the report of the present Committee of Inquiry should not be neglected as was that of the Newton Committee, but should, on the contrary, become the basis or plan for action, to be progressively developed over a period of years, backed by the stimulus of a continuous campaign of education and propaganda to secure public understanding and approval.

42. Finally, if the Committee accepts the view that the formation of public opinion is essential for the solution of the problem, then it is suggested that a first important step may be taken through its own report. This could provide an exceptional and most important opportunity for making a sharp and compelling impact in responsible quarters and among the public generally; an impact we believe to be urgently necessary. We are not suggesting that such " impact " will solve the difficult problems that have to be faced, but that it can provide the impetus which may lead to this hitherto badly neglected problem being given much higher priority in the affairs of the nation.

APPENDICES

The extension of principles of smoke prevention to which the Society attaches much importance, namely, Smokeless Zones and Prior Approval, have been advocated in the foregoing proposals. The following notes are intended briefly to indicate some of the points we would wish to be noted in the consideration of these subjects. The notes on legislation in the U.S.A. and Canada are included for comparison with the present legislation in this country and the proposals we have made for its improvement.

I. Smokeless Zones

1. Smokeless zones have been advocated by the Society since 1936 and the principle has been endorsed by the Simon and Ridley Committees. Two such zones have been established and others are being planned by some of the 17 local authorities which have obtained the necessary statutory powers.

2. Smokeless zones provide the most practicable means for securing, at an early date, in the areas most seriously affected by pollution, the smokeless conditions that cannot be obtained for many years for the country

as a whole. Smokeless zones may be quite small at first, but can be expanded, stage by stage, as conditions permit. One of the merits of the principle is its considerable flexibility in relation to time, area and means of enforcement.

3. The first smokeless zones to be established, in Coventry and Manchester, are proving to be successful, and in both cases expansion is being planned. It was previously thought that small initial zones in central areas would show little real change in conditions because of the drift of pollution from outside. In Manchester, however, according to those living and working in the area, there already appears to have been a significant improvement. In a newspaper phrase it has made " a window in the fog."

4. It is regretted that the first scheme for smokeless zones that included a substantial number of private dwellings should have failed to obtain Ministerial sanction. The equivalent of a residential smokeless zone has, however, been established both at Bradford and on the Clifton, Nottingham, housing estates, where the use of smokeless fuels is a condition of tenancy. The schemes appear to be successful and suggest that although it may be difficult to persuade householders to change to smokeless methods for the purpose of preventing smoke, when there is no certainty that their neighbours will do the same, the change will be accepted when it is required of a whole community.

5. Smokeless zones have considerable merit as a means for smoke prevention that can easily be understood by, and appeals to, the general public. This has been noted by the Society in advocating and discussing the idea, and is being found as a result of practical experience in Manchester. The creation of an interested public opinion in the problem of air pollution, stressed in the last section of the Memorandum, may thus be promoted by the tangible example of smokeless zones.

6. It is recognized that difficulties may arise in defining and enforcing the provisions of a smokeless zone in areas where for the time being the use of bituminous coal in certain industrial plant must be accepted for technical and economic reasons, or in cases where it may be desirable to promote the use of bituminous coal in mechanically-stoked appliances in order to liberate solid smokeless fuel for domestic purposes. (See paragraph 12(1) of the Memorandum). In such areas methods of control such as those laid down in certain U.S. Ordinances, including control over the sale of fuels, may be called for.

7. The number of smokeless zones or areas in which the use of fuel is restricted (as suggested in the preceding paragraph), must depend on the availability of smokeless fuels and of suitable appliances, both industrial and domestic. It may therefore be necessary, especially at first, to control the size, situation and numbers of proposed zones and to place their establishment in some order of priority. This, in our view, should remain a responsibility of the Ministry of Housing and Local Government, as it is under the smokeless zone clauses of existing local Acts. The study of the situation and the making of recommendations to the Minister could be one of the duties of the Standing Committee discussed in paragraph 18 of the Memorandum.

II. Prior Approval

1. Whether a fuel-burning installation causes smoke or grit nuisance depends in part on the installation itself. To seek to prevent pollution by allowing an unsuitable or inadequate installation to be erected, and then, after emission has been experienced, to penalise the owner, is clearly less logical than ensuring from the start that the installation can be used without offence. Prior approval is of course commonplace in other fields, including building regulations and byelaws, and its general extension to smoke prevention introduces no new principle. It has in fact been included for many years in one section of air pollution control law, the Alkali, etc., Works Regulation Act, 1906 (Section 9(5)). Provisions which would have required prior approval were included in the Public Health (Smoke Abatement) Act, 1926 (now the Public Health Act, 1936 (Section 104(2)), when it was enacted that " Building byelaws may require the provision in new buildings, other than private houses, of such arrangements for heating or cooking as are calculated to prevent or reduce the emission of smoke."

2. In recent local legislation only the Preston Corporation Act, 1947, gives full prior approval powers, but in other cases a permissive form is included, by which if plans for new installations are submitted for approval, then subsequent action cannot be taken under another section which prohibits new installations which are not " as far as practicable capable of being operated continuously without emitting smoke."

3. Comprehensive powers for prior approval are included in all recent U.S.A. and Canadian ordinances, as indicated below, and many years ago the introduction of the principle by the Bengal Smoke Nuisance Commission (on the advice of an English Smoke Inspector) resulted in a steady and remarkable reduction in smoke emissions over a period of years. We are not aware of any case where prior approval provisions have been found to be unworkable or to have resulted in objections from industrial interests after their adoption.

4. We do not advocate making prior approval dependent on a prescribed code of detailed standards and specifications, which has been done in some instances in the U.S.A. In other words the local authority should not attempt to prescribe what should be done but should merely approve, or not, what may be proposed. This does not, however, rule out a code of general guidance, in broad terms, such as that drawn up in Manchester, for the more common kinds of installation.

5. While it is considered that plans and specifications of proposed new installations should be submitted to the local authority or joint committee, and the certificate of approval issued by them, it will be necessary in many cases for the technical examination of the proposals to be examined by a local or regional panel of qualified persons, on which industry could be directly represented. In the case of highly specialized plant such as electricity generating stations, gasworks and complex manufacturing processes, alternative methods of ensuring prior examination already exist (as through a public inquiry) or could be carried out at central Government level, provided that the local authority concerned is duly represented.

III. Legislation in the U.S.A. and Canada

Legislation in the U.S.A. is on a city or county basis and the many ordinances in force vary in detail. It is therefore difficult to review the position as a whole, but the City of Pittsburgh Ordinance, 1941, which has led to considerable improvements, may be summarized as typical of the general trend today.

Smoke is restricted under Ringelmann chart standards under which smoke is graded into five shades : No. 1, a light haze ; No. 2 is somewhat darker ; No. 3 still darker ; No. 4, dense black and No. 5, 100 per cent. black. A No. 1 emission is allowed at any time by any stack. When starting or cleaning a fire No. 2 smoke is allowed for a period or periods aggregating nine minutes in any one hour, or in excess of No. 2 smoke for a period of six minutes in any one hour.

The ordinance requires all industrial and commercial establishments and, since 1947, all private residences, to do one of two things : either (1) use smokeless fuel, including coal of not more than 20 per cent. volatile matter content, or (2) use a mechanical furnace or stoker or other device approved by the Bureau of Smoke Prevention.

Except for private residences, annual inspections of heating equipment are made, a fee charged and a certificate of operation granted by the Bureau.

All new installations must be approved by the Bureau. A permit to start work is issued and, after completion, a certificate of operation is issued.

All coal dealers working in the city must take out a licence. It is illegal for them to deliver high volatile coal except to establishments having approved smoke-preventing equipment.

Violators of the ordinance may be taken before a magistrate who may impose fines or imprisonment. The Bureau has the authority to seal a smoking plant and prevent its use until proper adjustments have been made. Railways and steamboats also come under the ordinance but the restrictions differ slightly from the above.

The emission of fly ash—grit and cinders—is controlled by reference to a permitted standard, namely 0.30 grain per cubic foot of flue gas at a stack temperature of 500° F., of which not more than 0.2 grain per cubic foot is retained on a 325 U.S. Standard sieve.

A recently published tabulation of some U.S. ordinances show that out of a total of 50 listed the numbers which have sections dealing with the following matters are :

Smoke restrictions on Ringelmann Chart basis ...	45
Smoke and ash restrictions for locomotives	37
Fly ash standards (similar to Pittsburgh)	33
Installation permits required	42
Operational permits required	38
Annual inspections	20
Control of fuel and equipment sales	21
Restrictions on use of high volatile coals	14
Power to seal installations	30

The number of smoke inspectors employed varies considerably, but in the larger cities it is much larger than any British city. Thus Chicago employs 40 inspectors, Detroit 19, Los Angeles County 34, New York 29, Pittsburgh 13 and St. Louis 15. The highest annual budget is that of Los Angeles County, which spent $644,889 in 1952. Pittsburgh's expenditure, however, was only $81,000 and that of St. Louis $91,200. In many cases a substantial proportion of the administration cost is recovered by fees paid for the certification of plant.

Canada

Air pollution control in Canada closely follows the U.S.A. pattern and is summarized in the following paragraph from a recent paper[1] :

" Information obtained from 44 of the larger population centres in different parts of Canada is summarized (and shows that) of these 17 had no byelaw, 8 had byelaws passed before 1946 and 13 after that date. As might be expected, the Prairie provinces have very few detailed ordinances ; namely two in British Columbia and one in Manitoba. With the exception of St. John (N.B.) there is none east of Quebec City, all the others being in Ontario and Quebec. In most of the latter the smoke clauses are based on the Ringelmann chart, which, with all its faults, is the most convenient means available to outside inspectors for checking pollution. In a few cases the emission of dust and fly-ash is limited to a maximum stack loading of 0.85 lb. per 1,000 lb. of gases (adjusted to 12 per cent. CO_2), but this provision is of doubtful value owing to difficulties of measurement and enforcement.

" Most byelaws prescribe smoke indicators (or some means whereby the operator can see the top of the stack), and require installation and operating permits. Suppliers of combustion equipment also are directed to report all sales of such equipment, but in very few cases is there any limit to the volatile content of the coal that may be sold. The fees for permits vary in amount and in some instances they are scaled to suit variations in the size of capacity of the equipment. One or two corporations also specify annual inspections of combustion apparatus. In most cases, domestic installations are exempted from the provisions of the byelaw. Most of the ordinances contain general statements prohibiting the emission of odours and noxious gases, but no provision is made otherwise for their measurement or control."

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[1] By Professor E. A. Allcut, Department of Mechanical Engineering, University of Toronto, at a meeting of the American Society of Mechanical Engineers, New York, 29th November to 4th December, 1953.

John H. P. Taylor

We greatly regret having to record the death on 29th April of Councillor John H. P. Taylor, President of the Scottish Division of the Society. Mr. Taylor had been keenly interested in smoke abatement and the Society for many years and had been President since 1950. He presided over one of the sessions of the national conference in Glasgow last year, and the happy atmosphere of the Scottish divisional conferences in recent years was undoubtedly helped a great deal by his own friendly, genial personality and sincerity. He will be greatly missed by our members north of the border.

Councillor Taylor, who was a textile manufacturer's agent, was elected to the Glasgow City Council in 1943, and represented the Kelvinside Ward as a Progressive Party member. He was a member of a number of committees of the Council and for two years was sub-convenor of the Health Committee and had also been a magistrate. During the first world war Mr. Taylor was a lieutenant in the Royal Navy and was principally engaged in anti-submarine operations.

SMOKELESS ZONE NEWS

A debate on smokeless zones was held in the House of Commons when the City of London (Various Powers) Bill came up for second reading. This Bill contains a clause which would permit the City to establish a smokeless zone. Sir Herbert Williams and five other Conservatives proposed that this clause should be omitted, but Sir Herbert explained that his main purpose was to stimulate public interest in the problem, and he added that he hoped the clause would ultimately be passed in an amended form. A group of Labour members led by Dr. Barnett Stross also proposed that after the second reading provisions should be inserted requiring the Common Council to publish an analysis of the atmosphere annually for at least ten years, starting this year.

After the debate Sir Herbert Williams and Dr. Stross formally withdrew their motions and the bill was sent to committee unencumbered.

★

Contending that the new laws would impose an unreasonable burden on property owners, the Associated Owners of City Properties opposed the smokeless zone proposals when the City of London (Various Powers) Bill was discussed by a committee of the House of Commons. While expressing complete accord with the objects of the Bill they submitted that: " If Parliament should see fit to pass the clause, it should be on condition that the prohibition should apply only to new and modernized buildings and that it should only operate in regard to other existing buildings as and when they are modernized or substantial alterations in the heating arrangements are carried out."

Dr. C. Metcalfe Brown, Medical Officer for Manchester, gave evidence that the original scheme for a smokeless zone in Manchester of 104 acres was so successful, that the Council was proposing to extend the area to a total of 412 acres. The Committee decided to approve one of the contested clauses, with the addition of two modifications suggested by the City Corporation, the promoters of the bill.

*

A survey which is being made of the proposed smokeless zone in the centre of Glasgow has almost been completed, the Beaver committee was told when the members visited Glasgow recently.

*

Derby Town Council has approved a recommendation that the Special Purposes Committee should be asked to consider the inclusion of powers to establish smokeless zones in the borough in any General Powers Bill that might be promoted.

*

Oxford is preparing plans for a 100 acre smokeless zone in the centre of the city. Proposed by Mr. Wilfred Combey, Chief Sanitary Inspector, the area is in the oldest part of the city and contains several colleges. Since November instruments have been recording the sulphur content of the atmosphere and results show that the pollution rate approaches that of some large industrial towns.

*

A proposal made by Willesden Council that the Middlesex County Council should promote a bill to enable local authorities in the county to establish smokeless zones has received support from several other authorities in the area, including Hendon, Harrow and Wembley.

A Parliamentary Bill for the establishment of a smokeless zone in Newcastle has been suggested by the city's Health Committee. At a meeting last month it was decided to ask the Parliamentary Committee to receive a deputation and to invite neighbouring Tyneside authorities to a joint conference.

*

Walsall, which had intended to make its new Mossley Estate smokeless by means of tenancy agreements prohibiting the burning of raw coal, has had to reconsider the idea because half the houses will be all-electric and will have no provision for a gas-poker to ignite a coke fire.

*

The House of Lords Select Committee which is considering the Birmingham Corporation Bill has decided that the clause providing for smokeless zones to be established should not apply to railway locomotives. The Corporation had submitted that the smokeless zone clause should apply to locomotives, with an addition to enable the Minister of Local Government to avoid including them "until he sees fit to do so." Mr. Gerald Thesiger, Q.C., for the promoters, said that the British Transport Commission had a special, absolute and perpetual protection, in that railway locomotives were exempted from the operation of any of these orders. "They have got away so far with total exemption, unqualified, and it is upon that point that we are at issue with them."

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Stop Press—Rochdale's smokeless zone, described in detail in our issue of Spring, 1949, becomes operative on 5th July, 1954, and Salford has secured Ministerial approval for two smokeless zones to take effect on 1st January next. These are small compared with Salford's original scheme but are noteworthy because they are the first statutory smokeless zones for residential areas.

MANCHESTER AND THE BEAVER COMMITTEE

A MEMORANDUM drawn up by the Town Clerk (Mr. P. B. Dingle) and the Medical Officer of Health (Dr. C. Metcalfe Brown) of Manchester and submitted to the Beaver Committee, has been published. It is not only an excellent statement of the case but is evidence derived from practical and successful experience, especially in the matter of smokeless zones and prior approval.

An account is given of the first smokeless zone in the centre of Manchester—which it is estimated has stopped over 3 tons of smoke a week being poured into the atmosphere—and it is stated that " The central smokeless zone has now been operating successfully for nearly two years and the Corporation have had excellent co-operation from the owners and occupiers of all the premises. Very few offences have been detected, and in no case has it proved necessary to institute legal proceedings for contravention of smokeless zone provisions."

Reference is made to the proposals for the extension of the zone, the order for which is now awaiting confirmation by the Minister of Housing and Local Government. On the effects of the zone the memorandum says:

" The Corporation are satisfied from their experience that the enactment of Section 35 of the Act of 1946 has been well justified: there has been a noticeable improvement in visibility in the central area and many observers have remarked upon the difference in visibility in the smokeless zone compared with visibility in the area surrounding it. Apart, however, from the tangible results of the policy the psychological effect has been tremendous: Manchester is now ' smoke conscious ' and public opinion in the City is ready for a marked extension of smoke prevention measures."

Prior Approval

Manchester's experience of prior approval, which is still opposed by some industrial interests, is extremely important, and it would be astonishing if the Beaver Committee in the face of such evidence do not give the principle their full support. The memorandum says:

" Advances in modern technical science in fuel combustion and smoke abatement have resulted in the manufacture of industrial fuel burning plant which, if properly handled, will function smokelessly or as far as practicable will eliminate smoke.

" Indeed for the last twenty years the Corporation have stipulated that persons erecting factories on their Wythenshawe estate should undertake that every furnace or boiler should be approved by the Corporation before installation with the object of enabling the Corporation to satisfy themselves that so far as practicable the furnace would be smokeless in operation: this policy has been very successful.

" A policy of this kind is infinitely better than the policy underlying the provisions of the Public Health Act, 1936, which, as we have said, is based on the abatement of smoke nuisance after it has occurred: obviously it is much more effective to ensure, before it is installed, that a furnace embodies the best practicable means of smokeless operation. "

The memorandum then describes the prior approval powers obtained in the Manchester Corporation Acts of 1946 and 1950 and comments:

" Plans and particulars of proposed furnaces may be submitted to the Corporation for prior approval, though this is not obligatory, but in practice it has been found that in most cases where new furnaces are proposed to be installed architects or consulting engineers approach the Corporation at the outset and, where necessary, amend their proposals to ensure that the proposed installation conforms with the statutory requirements.

" Industrialists have met their obligations in a spirit of ready co-operation: indeed they have expressed appreciation of the technical advice given by the Corporation particularly as in many cases the advice has resulted not only in the elimination of unnecessary smoke but also in economy in fuel and labour by the adoption of mechanical stokers and other adjuncts to boiler-house efficiency."

The memorandum concludes with a five-point plan for action that is necessary if the Corporation is to secure a progressive reduction of air pollution in the City in the next few years:

1. Compulsory equipment of all new houses with smokeless appliances with suitable means of ignition.
2. Financial incentives to encourage where necessary the installation of smokeless domestic appliances in existing dwelling houses.
3. Provisions in the 1946 and 1950 Acts relating to smoke prevention in new industrial installations to be made applicable after a specified period to existing furnaces.
4. The large-scale production of cheap smokeless solid fuels to make possible smoke prohibition in residential areas.
5. Development of a smoke abatement advisory service by local authorities should be encouraged.

The Coal Trade Looks At Smoke

The pre-1939 attitude of the coal trade to smoke abatement will be remembered by many of our older members as a defence of the coal fire and an effort to belittle the smoke abatement movement. Times have changed and the trade, of necessity, has moved forward a great deal. But not, as recent reports reveal, at a uniform rate.

On the one hand we have the fine, forward-looking example of Messrs. Charrington's, whose perambulating advertisement of solid smokeless fuels is illustrated on another page, and the remarks of Mr. C. Stuart Clarke, Chairman, at a luncheon of the Society of Coal Merchants on 23rd April. We quote from the *Coal Merchant and Shipper*:

" If they were shortsighted (said Mr. Clarke), they might view the future with despondency in view of the cries that were going up in the country for smokeless zones. What would become of their business; how were they to survive if the use of bituminous coal was to be prohibited, for it was bituminous coal that produced the smoke and there was four or five times as much bituminous coal used domestically as there was smokeless solid fuel? The prospect darkened even more when they heard from the experts that they could hold out little hope of inventing appliances which would enable bituminous coal to be burnt smokelessly on domestic fires.

"But they were not yet downhearted. They in the Society of Coal Merchants used as their emblem the ancient crest of the Worshipful Company of Woodmongers and Fuellers, which was founded in 1605. They were still fuellers, though no longer woodmongers. The woodmongers gave way to coal and the further process was already beginning. No longer were they just coal merchants; if it were not such a mouthful they might call themselves ' solid fuel merchants.' They might even become ' smokeless solid fuel merchants.' "

On the other hand, however, Mr. J. Wood-Smith, Vice-President of the Coal Merchants' Federation of Great Britain, speaking at a dinner in Nottingham on 7th April, said that air pollution was so often blamed on coal fires, and he urged that members should " take up the fight " to make sure that air pollution and smoke abatement were " kept in their proper channels."

" Smoke Reduction "

The general attitude of the coal interests is exemplified by the title chosen for the " smoke reduction " conferences sponsored by the Coal Utilization Council and the Combustion Engineering Association in London and Birmingham and a similar C.E.A. conference in Leeds. The National Smoke Abatement Society is often criticized for retaining the half-hearted term " smoke abatement," but smoke reduction is even more cautious and diffident. Nevertheless, some useful things were said by some of the speakers at these conferences, and even emphasis on how difficult it all is helps to draw attention to the problem. At the Birmingham meeting, however, Mr. W. C. Moss, Technical Manager of the C.U.C., went into opposition, not only to this Society but to the Simon and Ridley Committees by criticizing smokeless zones as follows:

" The present trend towards smokeless zones," he said, " imposing considerable hardship on the householder particularly and yielding little benefit, since smoke drifts in from surrounding areas—the smoke deposits in the centre of Hyde Park in London have proved this—seems misguided. A better approach would be to get as much reduction of smoke as possible all over the country."

(Mr. Moss, unlike the Beaver Committee, which even in its Interim Report indicated the need to concentrate attention on the black spots and smog areas, clearly believes that smoke abatement is as important in Glastonbury as in Glasgow, in Salcombe as in Salford! The Hyde Park analogy was shown, a long time ago, to be unsound, and today there is much better *real* evidence from a smokeless zone in being—see Manchester's official statement on another page).

A somewhat different C.U.C. attitude seems, however, to be suggested by Mr. Eric Bellingham, Director-General, who appears to be much more impressed by the value of smokeless areas than does his Technical Manager. Speaking at Nottingham recently, according to the *Nottingham Guardian*, he described the Clifton smokeless housing estate (described in our Autumn, 1953, issue) as " a really worthwhile experiment." " We are watching," he said, " this new housing estate experiment for preserving an unpolluted area with great interest."

Sir Brian Robertson, chairman of the British Transport Commission, stated in Edinburgh recently that he was looking forward to the establishment of diesel train services on the Edinburgh–Glasgow route. Speaking at the annual dinner of the Scottish section of the Institute of Transport, Sir Brian said that the first multiple-unit lightweight diesel trains in a £2 million construction programme were nearing completion and would be ready for trials in a month or two. He considered that the Edinburgh–Glasgow route would provide a valuable test for the potentialities of fast diesel services between important cities. " They ought to make some contribution to the abatement of the smoke nuisance," he added.

Atmospheric pollution has so defaced three statues being removed from Peel Park, Salford, to make way for foundation work on extensions to Salford Royal Technical College that they may not be put up elsewhere. Inspection showed that a marble statue of Richard Cobden, put up in 1867, was so defaced that the features were indistinct and the hands withered. The other two, bronze figures of Sir Robert Peel and Mr. Joseph Brotherton, were also badly corroded.

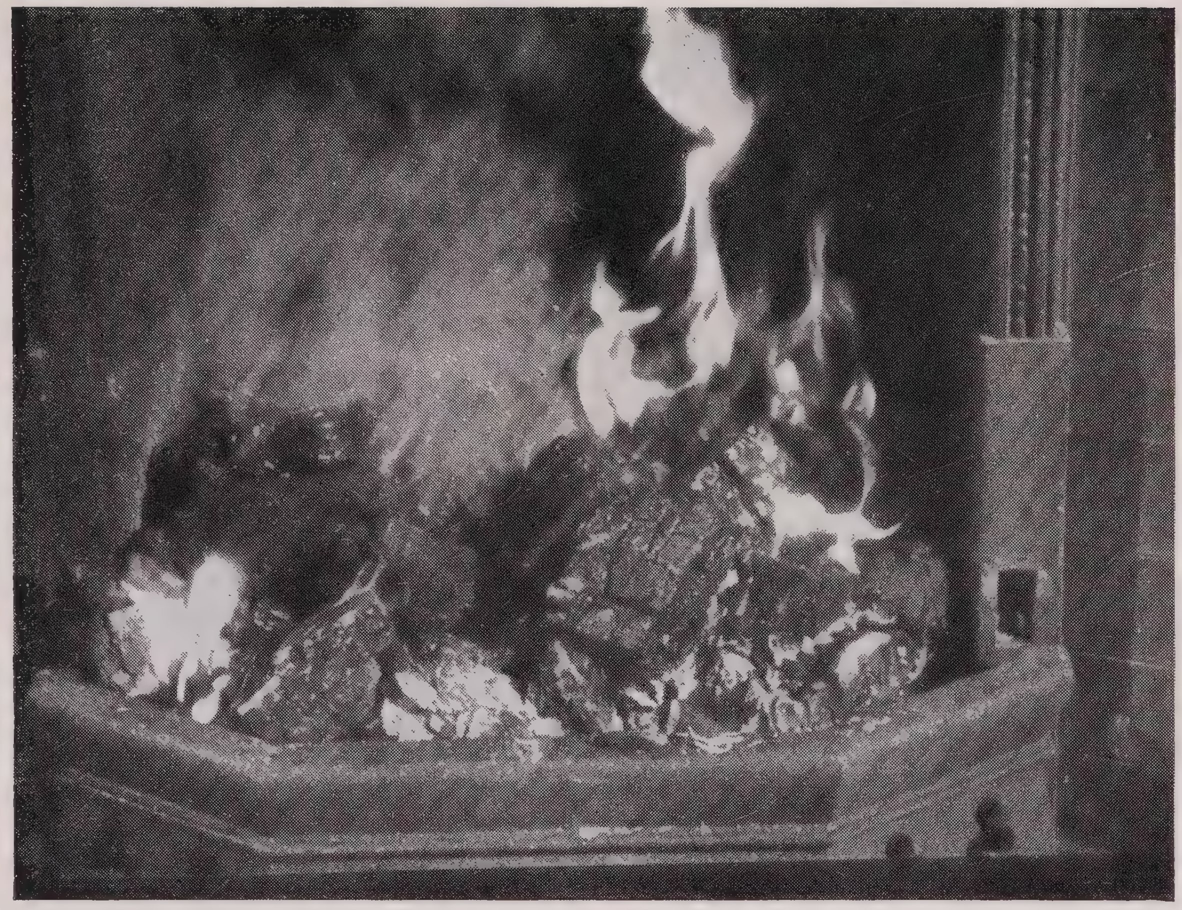
GUILTY CHIMNEYS — ON THE SCREEN

Many readers will have seen the film produced in the thirties by the British Commercial Gas Association, " Smoke Menace." It is still an excellent film and good propaganda, but now obviously dated, and credit goes to the Gas Council for producing another film on smoke—" Guilty Chimneys." The title—by friendly arrangement—is the same as one of the Society's publications, and to a degree we can say that this is the film of the book, though far more alive. It is a first-class, convincing documentary, vivid and dramatic without anywhere overstating the case, and although gas and coke naturally get honourable mentions, it is first and foremost a smoke abatement and not a gas or a coke film.

It opens with idyllic scenes of clean air and sunlight and passes on to smoking chimneys of all kinds, culminating in a city smog and an ambulance groping its way to a hospital at night, and the narrator saying: " That ambulance you saw wasn't coming from an accident. Let's be kind and call it manslaughter . . . or if you like, murder. We haven't caught the culprit though we know him well; for we created him. If this patient had been poisoned by fumes in a chemical plant there'd be a clear case. As it is we'll put down ' heart failure ' or acute bronchitis. What we know quite well is, if it weren't for the smoke and fog outside, he'd be home at this moment—as it is, in a week he'll be dead, as were four thousand like him in London alone in a few disastrous days in December, 1952."

From here visual scenes and narra-

Ambulance in the smog—a dramatic moment in the new film " Guilty Chimneys "



Another still from " Guilty Chimneys "—one of the most effective photographs of a smoking coal fire we have seen

tors explain what air pollution does, going on to show a lecturer telling his audience how the problem can be solved and ending with a scene of children playing in the street of a smoky town, and then walking away, hand in hand, through the murk . . . while to a background of a children's choir the narrator says: " Out of gloom and darkness let us strive towards the light, not reaching for the moon but asking that we might see the sun. . . ."

The film was produced for the Gas Council by the Pathé Documentary Film Unit, and was written and devised by Mr. Jack Howells. Its fine imaginative quality will make it first-class propaganda and the Society looks forward to showing to at the conference in Scarborough next September. It is not yet available for loan for film displays or meetings but will be shortly, and inquiries for further details should be made to the Films Officer, the Gas Council, Gas Industry House, 1 Grosvenor Place, London, S.W.1.

In the first prosecution of its kind in Bristol, the Bristol Tramways and Carriage Company Ltd. was fined £3 for permitting a bus to be used in a condition where it emitted smoke which could have been reasonably avoided. Mr. T. D. Corpe, who tendered a plea of guilty on behalf of the company, said that in order to prevent a recurrence of the nuisance a member of the company's maintenance staff would be stationed on the roads to keep watch.

Towards Clean Air

via

Smokeless Zones[*]

By W. R. Martine, O.B.E., T.D., M.D., D.P.H.
Executive Council Chairman, N.S.A.S.

IT must be seldom that a dream comes true, and rare, indeed when fulfilment comes in the lifetime of the dreamer. What gratification, therefore, to the late Charles Gandy, Manchester lawyer and life-long smoke abatement pioneer, that he should know before his untimely death in 1950 that a number of Local Authorities had already sought powers to establish Smokeless Zones, while in two of these, Coventry, and his home town of Manchester, plans for establishment were well in hand.

Charles Gandy was an individual member of the National Smoke Abatement Society from its formation in 1929, and Chairman of its Executive Council from 1934 to 1950. He held two views which label the man for the idealist he undoubtedly was; he was convinced that we had tolerated far too long the polluted atmosphere of our urban and industrial areas, with its attendant damage to health and drain upon our economy, and he believed, at the same time, that it was not abatement so much as elimination that was necessary. He believed, too, from personal experience in his own home, and from his contacts with fuel efficiency experts and others " in the know," that smokelessness could be achieved if existing knowledge were only used to the full, and it was in 1935 in a letter to the Press that he first put forward the suggestion of the Smokeless Zone.[1]

He realized, however, that Utopia must be far off if only because of the many bridges to be crossed: the provision of an adequate supply of solid and other smokeless fuels, the mechanical stoking equipment, the expansion of manufacture of efficient modern domestic fire grates, and the education of all concerned. Dare I suggest that those concerned include the Member of Parliament, the local Councillor, the Surveyor, the Architect, the Builder, the Housing Manager, the Schoolteacher, the Parent and the Housewife as well as the much blamed Industrialist.

A strong public opinion would have produced results years ago, but the public are still wedded to their inefficient open fire and to the old slogan, that " where there's muck there's money."

Smoke Abatement is a dull and unpopular subject compared with others on the Health Education Programme of the Local Authority, and I must admit that I have rarely spoken on this subject at my first visit to any association; I have usually had to create interest first by giving a talk on some other branch of my work in Birmingham. You have, therefore, shown some originality in not requesting a talk on the construction and layout of a kitchen as part of our Clean Food Campaign, and I should like to underline my appreciation of that originality for I take it as an indication that responsible public opinion is changing. I believe that the advocate of the abolition of the smoke nuisance is no longer universally held to be a crank, as he was 25 years ago, but it is surely to be deplored that a 5-day smog—a mixture of fog with the products of incomplete and inefficient combustion of fuel—had to occur in London a year ago, and be closely associated with more than 4,000 deaths, before public opinion was sufficiently roused to demand action.

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[*] A Paper read to the Warwickshire, Staffordshire and Worcestershire Branch of the Royal Institution of Chartered Surveyors on 21st January, 1954.

Let us be thankful for good that may come out of evil, but don't let us forget that the appointment of a Committee on Atmospheric Pollution in 1953-54 is not the final answer. Its recommendations must be strong and fearless, and they must be implemented in full, or we shall benefit as little as we did from the Newton Report of 1920, the Simon Report of 1946 and the Ridley Report of 1952. It should not be forgotten that the Simon Report—on Domestic Fuel Policy—recommended the passing of legislation to enable Smokeless Zones to be established, and the declaration of a few such zones " mainly for experimental purposes."[2] That was nearly eight years ago, and Local Authorities are still having to struggle by means of local Acts and subsequent orders which then require to be approved and confirmed by the Minister. The Ridley Committee of 1952, on National Fuel Policy, moreover, appreciated the association between fuel efficiency and smoke abatement, and stated that there was a good case for more widespread declaration of Smokeless Zones, dependent only upon there being enough smokeless fuel and suitable appliances.[3]

The present position, therefore, is that apart from the two established zones in Coventry and Manchester, some 17 other Local Authorities have secured powers to establish—the first stage—while a number of others are seeking such powers at the present time. Birmingham is one of these. It is significant, however, that proposals put forward by Salford in 1951 were turned down by the Minister, while in Hull and Nottingham local opposition led to withdrawal of the proposed clause.

I should have liked to be able to enlarge upon the present position in Birmingham, but the case is *sub judice* in that our specific proposals are not likely to be put before the City Council until we have the powers to establish, as and when the Corporation Bill of 1953 becomes law. The Health Committee have, of course, discussed the project in general terms, and officers of the various Corporation Departments concerned have met and we are certainly not lacking in ideas.

For these reasons it would be difficult for me to deal with the subject in my official capacity here as Administrative Medical Officer of Health. Let me rather speak to you in my capacity as Chairman of the Executive Council of the National Smoke Abatement Society and deal with the subject on national lines.

What is a Smokeless Zone?

Firstly, what is a Smokeless Zone, and how does a Local Authority proceed to obtain it. In the conception of Charles Gandy, and now generally accepted, a specially selected area is prescribed by Order made under powers obtained by a local Act, and confirmed by the Minister, there being normally the proviso that the area may later be extended. Under the model clause[4] the emission of smoke from premises to which the Order applies is prohibited with provision for recurring penalty except where it can be shown that the smoke arose from an appliance suitable for authorized fuel and properly maintained and used, and that it resulted from the burning of that authorized fuel, or of other fuel when that authorized fuel was not available. The Order further specifies an authorized fuel or fuels. The Corporation may bear the financial cost, or part cost, of works or adaptation, while there may be provisions to enable a tenant incurring expense to vary terms of tenancy by agreement with the owner or, if unable to reach such agreement, to apply to the County Court for an Order as to such variation. All premises within the area shall be subject to the Order unless specifically excluded or deferred to a date specified.

Prior to submission of an Order to the Minister for confirmation the Corporation shall publish details of the Order in the *London Gazette* and local press and stating that objections should be sent to the Minister, with copy to the Town Clerk within 28 days, and if no objection is made the Minister may confirm with or without modification. If, however, an objection is made, a local enquiry must be held and its report considered before confirmation. Notice of confirmation must be posted and published and such Order will not come into operation for six months after publication of notice. There are the usual and unfortunate exemptions contained in the clause—these relating to smoke from railway engines, working of mines and certain of the metal industries.

Selecting the Area

There are several possibilities in the selection of the area to be prescribed. It may be that the Central Area is most suitable for a beginning, as in Manchester where a Zone of 104 acres, including 1,297 commercial premises, 118 light industrial undertakings and 68 dwelling houses,[5] has been rendered smokeless and provided what has been aptly described in a local newspaper as a " window in the fog." The venture has certainly proved successful, for an extension of a further 130 acres is now being planned.

In Coventry, a central area of some 30 acres which had been seriously damaged by enemy air attack seemed most suitable for redevelopment as a Smokeless Zone, containing as it did 91 shops, 31 offices, 8 banks, 7 licensed premises, a church, a warehouse, factories, clubs, 9 caretakers' flats and 2 private dwellings,[6] This came into being in 1951, and it is gratifying to learn that plans are in hand to extend the Zone to more than twice its original acreage. Efforts to establish Smokeless Zones in other areas such as housing estates have not been so successful, but there are undoubted possibilities in this direction.

Few objections had been raised when the Salford Scheme reached the Ministry enquiry stage and yet it was not approved, even with modification. The scheme was undoubtedly ambitious, including as it did three Zones of 750, 320 and 160 acres respectively, all principally residential and comprising some 5,000 houses, a third of which were in Corporation ownership.[7] Most of the objectors, while admitting the need for less pollution of the atmosphere and, indeed, the means of achieving that end, felt that the scheme should begin elsewhere and stressing the infiltration of smoke into these areas from outside. Old people who had lived long in these areas were actually produced as evidence by the objectors, but there was at the same time much local support, and objectors' meetings did not have the success anticipated. Whether shortage of suitable fuels led the Minister to take the course he took, or not, Salford will certainly try again.

The Hull case is also interesting in that it fell by the wayside when a town's meeting rejected the scheme proposed. The opposition came from representatives of property owners' associations, who like property owners in general fail to recognize how much they, of all people, pay for the damage resulting from smoke.

The Nottingham Council again were obliged to withdraw their scheme, but here what is in effect a smokeless zone has materialized without legislation. On a large post-war housing estate the use of smokeless fuels—in the suitable appliances provided—is made a condition of tenancy.[8] It has recently been reported also that in Bradford, who like Birmingham are seeking powers to establish Smokeless Zones at the present time, new post-war estates, comprising in all some 5,000 dwellings, are smokeless already by virtue of similar tenancy conditions.

It has to be said in regard to the objection of smoke infiltration, raised in Salford, that this serves merely to underline the ignorance of the objector. Tests which were carried out in Hyde Park, London, showed that on windy days pollution was only 27 per cent. of that in the surrounding area, and on calm days, with little wind to dissipate the nuisance, pollution in the Park was 85 per cent.[9] Thus if an area is ringed with smoke producing areas, some improvement may be looked for even under adverse conditions, and certainly the larger smuts to which the housewife so rightly objects, and which fall near their source, will be considerably reduced.

Additional possibilities naturally come to mind in connection with town planning and redevelopment. Clearly the newly planned industrial area should be a potential smokeless zone, like the new housing estate, while the mixed area of redevelopment, including industry and large blocks of flats readily lend themselves to such a scheme.

What Birmingham may do, it is yet too early to forecast, were I in a position to do so; but I can fairly say that proposals should be, and I believe will be, on such a scale as to make Birmingham envied by her neighbours, and I can assure you that we already have the promise of full co-operation from the nationalized industries and others without whom no such scheme could attain complete success. Meanwhile we must await the grant of powers, and then later, when our scheme is complete, the Minister's sanction, and hope that in between these stages we may be able to iron out any difficulties or doubts in the minds of any potential objectors.

And finally let me make this one remaining point. Initial establishment without subsequent extension can never reap the optimum or potential benefit, and it is therefore so very satisfactory that extension comprising areas larger than the original zones is under way in Manchester and Coventry and that the " window in the fog " is to be enlarged.

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1. C. Gandy, *Manchester Guardian*, 15th February, 1935.
2. Domestic Fuel Policy, 1946, Recc. 11, p. 30.
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4. *Model Clauses*, No. 79, 1950.
5. C. Metcalfe Brown, *Medical Officer*, 4th July, 1953, p. 8.
6. T. E. Willmott, *Smokeless Air*, Spring 1952, p. 121.
7. J. L. Burn, Proceedings of Portsmouth Conference, N.S.A.S., 1952, pp. 33-34.
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9. G. M. B. Dobson, Air Pollution Conference, London, February, 1945.

Diesel Warning

Warning operators about the emission of excessive exhaust smoke from diesel vehicles, *Motor Transport* says that the main causes are bad maintenance of the fuel injection equipment and the tampering with governors and excess fuel devices by drivers. In both cases the remedy lies with the operator. Maintenance should be improved and drivers should be subjected to stricter supervision. If essential, it suggests, disciplinary action should be taken against them.

Not all Smog

Newquay Hotels' Association is to ask the British Travel and Holidays Association what it can do to convince German people that Britain is not a land of smog. A former member of the Newquay Information Bureau staff now living in Rothenburg has written, saying: " I wish that England would send out better propaganda. Of every ten people I meet nine think it is always enveloped in thick, black poisonous fog—not only London, but our whole countryside."

SMOKE AND THE WASHING BILL

An E.A.W. Investigation

The inquiries, about 1920, into the cost of household washing in Manchester as compared with Harrogate, are familiar to all students of the air pollution problem and its economic consequences. They revealed, among much other information, that the housewives of Manchester spent £245,000 a year *more* on their " weekly wash " than they would have done if their environment had been as clean as that of Harrogate. The Electrical Association for Women have now conducted a most valuable inquiry of a similar nature by means of questionnaires to their members in many parts of the country, and have submitted a report on this to the Beaver Committee.

Summarizing, the following significant facts emerge:

1. The average weekly home wash weighs 17 lbs. in industrial as compared with 13 in rural areas.

2. The cost of the weekly wash (fuel and requisites) was 2s. 5d. per family in industrial and 1s. 10d. in rural areas. This is 2d. per head per week—which may seem small, but works out (our estimate) to a national *waste* of fuel, soap, etc., in the region of £8 millions a year.

3. The average time spent by the housewife on the weekly laundry work and ironing in the rural areas is 6 hours 42 minutes, compared with 7 hours 51 minutes in industrial areas.

4. The washing of net curtains (which act as excellent smoke deposit indicators) is shown to vary considerably even in similar areas, but the tables show that in a year every 100 curtains are given the following number of washings :

Rural areas	360
Medium-sized towns ..	420
Large towns	716

For heavy curtains the figures are 153, 177 and 221 respectively.

That these differences are not due to local habits or " house proudness " is shown by scientific tests also carried out on the actual discoloration of curtains hung for 28 days in different places. A reflectometer, which by means of a photo-electric cell measures the reflectivity of a surface, was used. White linen, giving originally a reflectivity of 100, and net giving an original reflectivity of 85, were used, and after the experiment the following readings were obtained:

Abinger Hammer (rural Surrey)	78	and	82
Midhurst (Sussex) ..	78	,,	82
Clapham	72	,,	78
Corby	68	,,	76
Manchester	64	,,	70
Leeds	50	,,	58

Factual evidence on the cost of smoke—so important for pressing the case for its abolition—is all too rare, and the E.A.W. are to be complimented on their enterprise.

New York Chamber of Commerce, alarmed at the city's average sootfall of 67½ tons per square mile per month, has issued a report calling for legislative action to control the nuisance on an area-wide basis. The report points out that smoke and fumes are being carried into the city from industrial establishments across the Hudson River and from Long Island in such volume as to limit seriously the effectiveness of any action taken within the city. The chamber is supporting an Assembly Bill which provides for 30,000 dollars to be devoted by the Inter-State Sanitation Committee to a study of air pollution. If approved it would take effect when New Jersey makes a similar appropriation.

This effective solid smokeless fuels advertisement, a pony-drawn miniature white cart, with bags of clearly labelled smokeless fuels, is an enterprise on which we would like to congratulate the well-known firm of Messrs. Charrington of London

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Stinking Air

Under the heading " Our Stinking Atmosphere," an editorial in a recent issue of the journal of America's Aircraft Owners and Pilots Association says: " Only the airplane pilot knows how terrible and widespread is this almost constant layer of waste products. Only an airplane pilot has had the unnerving experience of climbing his plane up through as much as *two* miles of the stuff, breaking out on top of this vast depth of pollution into bright sunshine, in a cloudless sky. A few city fathers have seen this frightening spectacle from the air—and have passed laws with teeth in them." Comments *Flight*, a British aviation journal: " It happens here, too."

Precautions taken by the British Electricity Authority to prevent ash pollution of the atmosphere from Meaford generation station are nearly 100 per cent. successful, Dr. Glynne Owen, medical officer of health to Stone Rural Council, states in a report compiled after five years research.

Speaking at the Cardiff College of Technology and Commerce on " The Industrial Use of Solid Fuel," Mr. G. H. Barnard, Regional Fuel Engineer for Wales, Ministry of Fuel and Power, said that half the boilers in use in Britain today are more than 30 years old, and expressed the hope that, in the interests of fuel efficiency, the hand-fired boiler would become a rarity.

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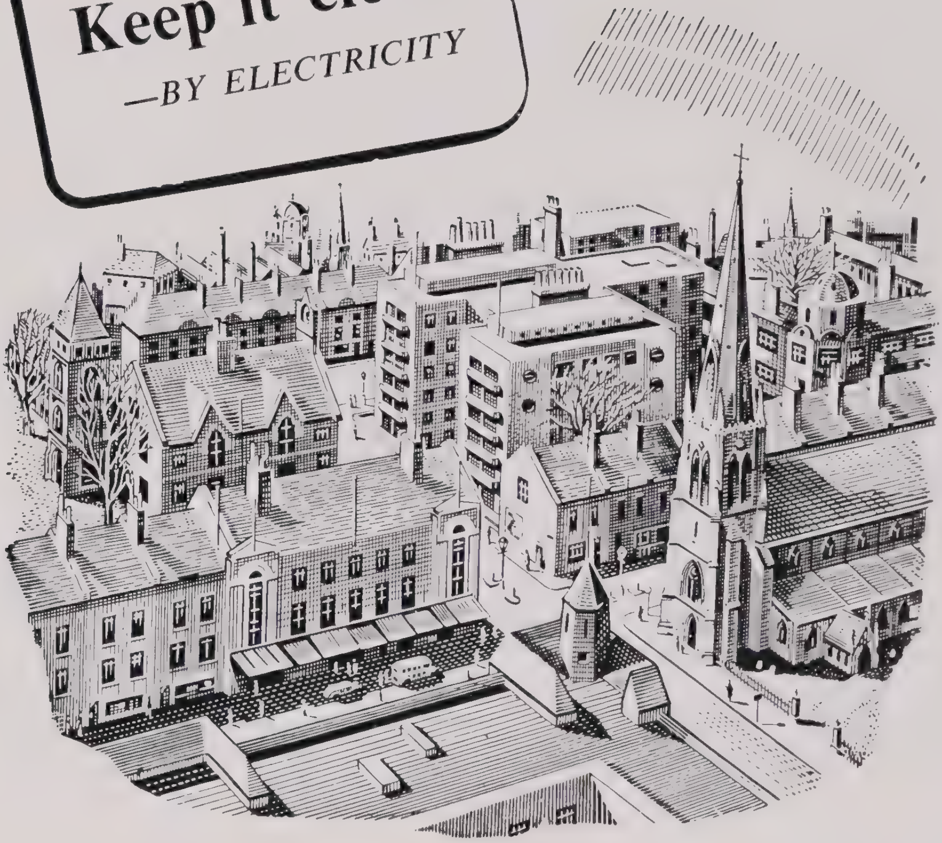

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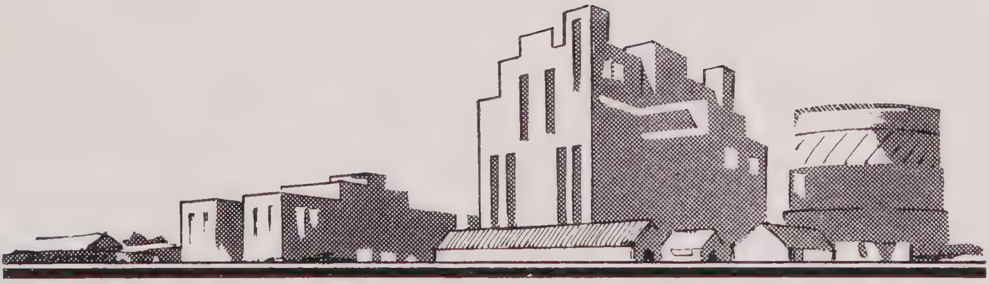

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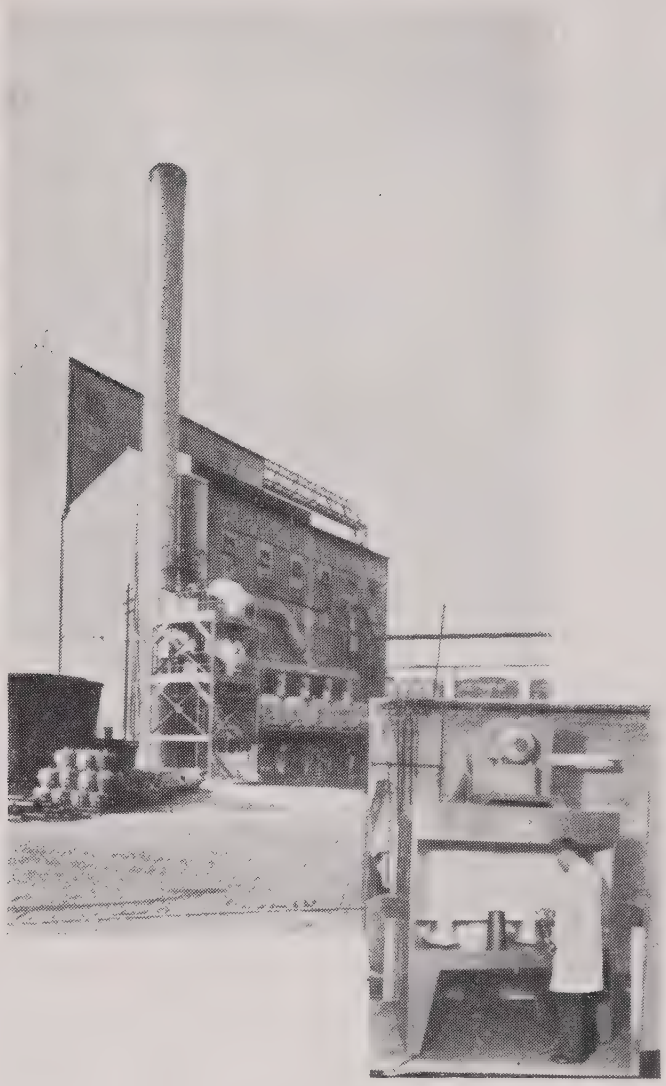

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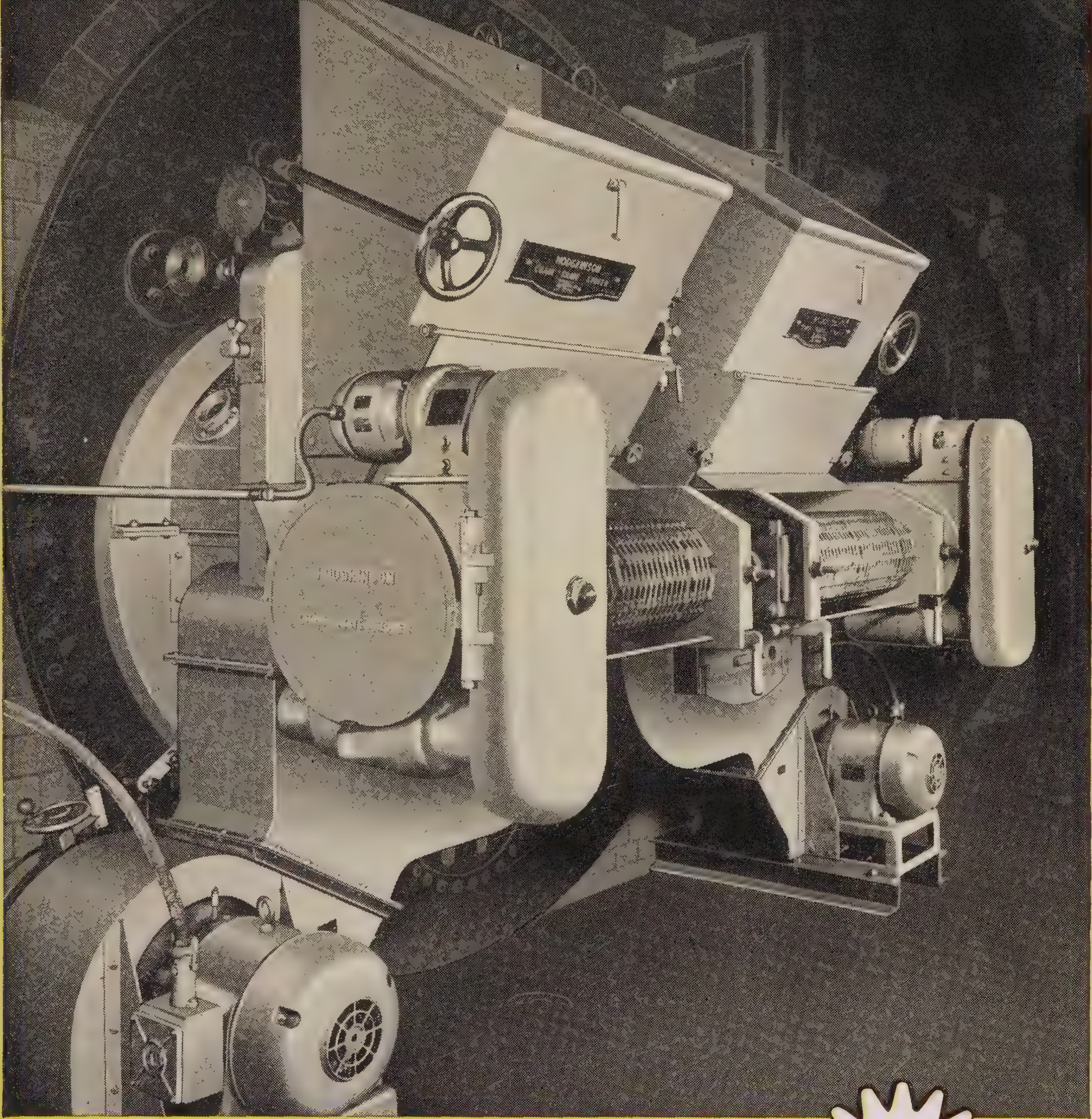

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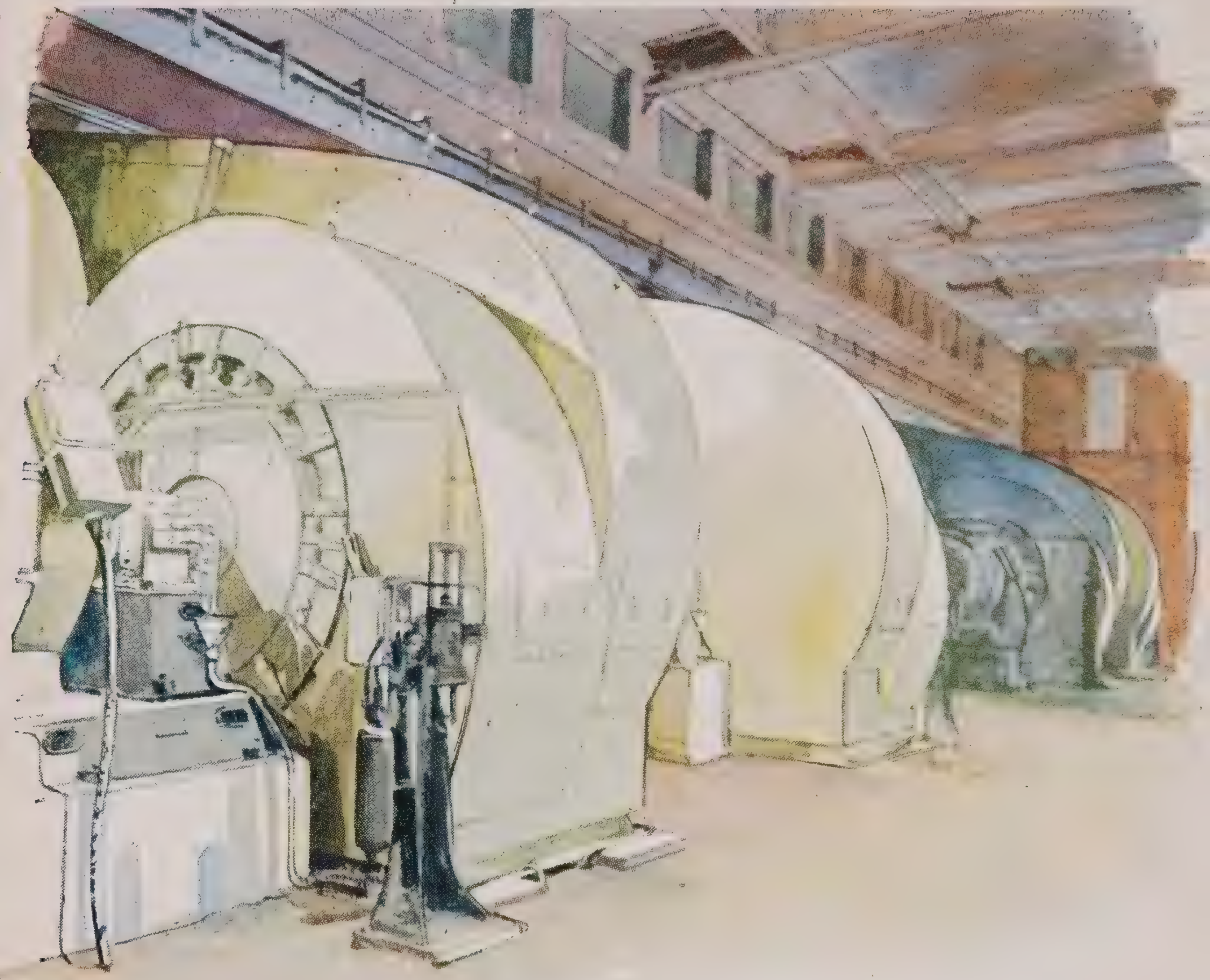

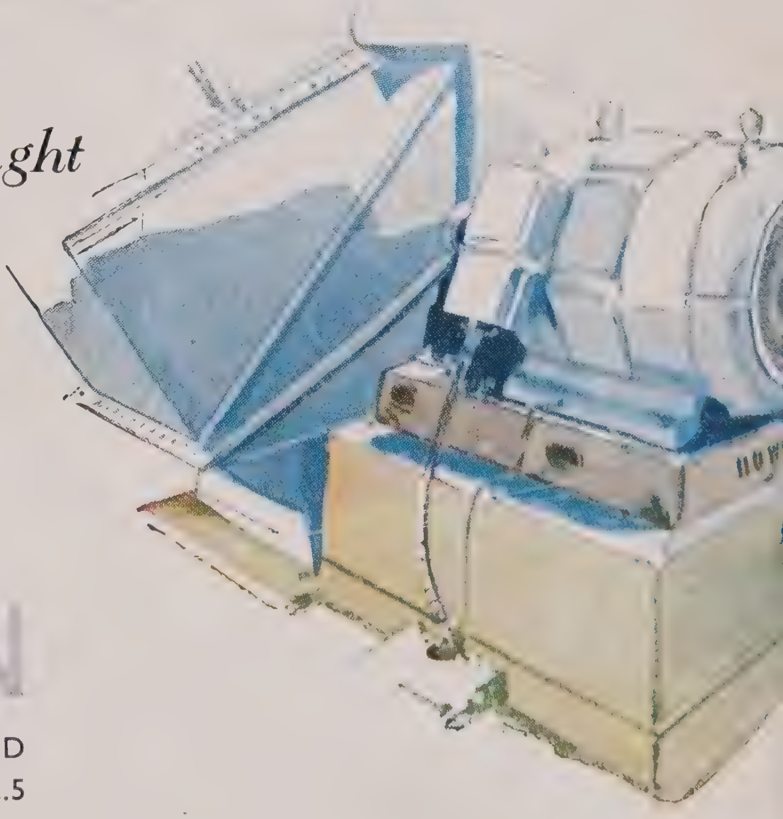

Howden induced draught fans at Kingston Power Station – and below – one of the Howden forced draught fans.

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